THE AGRIBUSINESS PROJECT (TAP)

Kinnow (Citrus)- Value Chain Competitiveness Assessment

Sub Agreement TAP-ISA-013-002

J.E. AUSTIN ASSOCIATES, INC.

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Acknowledgements

This report encapsulates the results of the Kinnow Value Chain Competitiveness Assessment (VCA) study undertaken by the USAID Agribusiness Project (TAP). The authors wish to thank all the associated organizations and their project staff for their valuable contributions, particularly the TAP value chain leads and the field staff for their tireless efforts spent during data gathering in the field.

Acronyms and Abbreviations

AOR	Agreement Officer's Representative
ASF	Agribusiness Support Fund
BDS	Business Development Services
BDSPs	Business Development Services Providers
FAO	Food and Agriculture Organization of United Nations
FEG	Farmer Enterprise Group
GAP	Good Agricultural Practices
IMLP	International Market Linkages Program
NGO	Non-Government Organization
M&E	Monitoring & Evaluation
SME	Small and Medium Enterprises
TRTA	Trade Related Technical Assistance Program
TA	Technical Assistance
UNIDO	United Nations Industrial Development Organization
USAID	United States' Agency for International Development
VCP	Value Chain Platform

Exchange rate used: US$1 = PKR 105.

I. Background

The USAID's Agribusiness Project, now commonly referred to as The Agribusiness Project (TAP) is being implemented through Cooperative Agreement (No. AID-391-A-12-00001) by the Agribusiness Support Fund (ASF). ASF, a Pakistani non-profit company registered under section 42 of the Companies Ordinance of 1984 was formed to provide demand-driven technical and managerial assistance and private sector service delivery mechanisms throughout the agribusiness value chains including supply inputs, production, processing and market access for domestic and export markets.

The five-year TAP project began on November 10, 2011. The overall goal of the project is to support improved conditions for broad-based economic growth, create employment opportunities and contribute to poverty alleviation through increases in competitiveness of horticulture and livestock value chains in partnership with all stakeholders. Specific objectives of the project are to; (i) strengthen the capacity in horticulture and livestock value chains to increase sales to domestic and foreign markets; (ii) strengthen the capacity of smallholders and farmer enterprises to operate autonomously and effectively; and, (iii) increase agriculture efficiency and productivity through adoption of new farming techniques and technological innovation among targeted beneficiaries.

ASF Tap had developed some basic information on many of the selected value chains targeted by the project. This information has been published in the following reports:

I. Horticulture (Peaches, Dates, Potatoes, Chilies) Value Chain Assessment Final Report for the Agribusiness Project (31 December 2012)

II. Dairy Value Chain Assessment Final Report for the Agribusiness Project (24 February 2013)

III. Meat Value Chain Assessment of the Livestock Sector of Pakistan (2 November 2013)

The present report is one of a series resulting from the effort to deepen the analysis provided in these reports by assessing the competitiveness of the selected value chains. These competitiveness assessments focused on the following:

a) Identification of the precise gaps in the potential of Pakistan producers in the selected value chains;

b) Validation of ongoing and planned interventions;

c) Identification of attractive/alternative markets for the value chain products;

d) Identification of additional interventions that could enhance value for all the chain actors;

e) Facilitation of further prioritization of VCs and of the potential interventions in light of the augmented information and analysis;

The methodology employed included refining maps of the functions and actors participating in each value chain, identifying variations in each depending on the product and relative efficiency of the different participants, and gathering as much information as possible on prices, costs, and efficiency metrics at each level, as well as volumes of product flowing through each of these channels. In parallel, world market information was obtained to assess Pakistan's recent performance in each chain's product(s), assess its relative position vis-à-vis international competitors considering volumes, prices and recent export growth, and benchmark the gaps between them.

The information sources used include a review of previous studies, interviews with adequate representation of all functions and participant groups in each value chain, including producers, intermediaries (contractors, commission agents, traders (beuparies), exporters, supermarkets, and input suppliers as well as key informants from among academia, and research and development professionals. The data presented in the reports primarily come from reports and databases published by the Pakistan Bureau of Statistics, Trade Development Authority of Pakistan (TDAP), Directorate of Market Information, Department of Agriculture Punjab, Economic Survey and other domestic and international secondary sources of information, particularly international databases such as International Trade Center (ITC) in Geneva and FAOSTAT. For each specific chain, various knowledge and information sources available on the Internet were utilized as well.

This document was designed to focus on the competitiveness of the selected value chain. However, this report should not be considered final. The report was conducted in a relatively short time (about 8 weeks) and given the amount of previous work on other value chains that was completed. Nevertheless, VC strategies should be "living documents" and be continuously updated as potential interventions are further tested and more information is uncovered.

Introduction

Citrus fruits originated in South East Asia and reached the Mediterranean region over 2000 years ago. In China, oranges were present, around 4000 years ago. Christopher Columbus took the lemon seed to North America in 1493 (Ali, 2004, pp. 23-24).

Ju Lu" (Record of Citrus), authored by Han Yanzhi in Southern Song Dynasty in 1178, records 27 species/varieties of citrus. The National Citrus Germplasm Nursery in China conserved 1190 major varieties/species of citrus in the 1980s taken from both China and around the world (Xinlu, 2001).

Kinnow was evolved (by H.B. Frost) as a result of the cross breeding of King and willow Leaf varieties of citrus at the Citrus Research Institute, University of California, USA in 1915 (Ali, 2004, pp. 23-24; Kinnow, 2008). Both of the parent varieties are of Indo-Chinese origin (PHDEB, 2005, p. 9).

In 1936, several varieties of citrus were experimented with on the Indian subcontinent. Kinnow reached this subcontinent during 1940s and the first two plants were planted at the Punjab Agricultural Research Institute (now known as University of Agriculture Faisalabad) (Ali, 2004, p. 153). The cultivars of kinnow and the feutrella were imported to Pakistan in 1940, kinnow from California and feutrella from Australia (Johnson, 2006, p. 2).

Taxonomy of the kinnow is as follows:

- Kingdom: Plantae
- Order: Sapindales
- Family: Rutaceae
- Genus: Citrus
- Species: C. reticulata

Product Specification:

- Citrus is most commonly thought of as a good source of vitamin C. However, like most other whole foods, citrus fruits also contain an impressive list of other essential nutrients, including

both glycaemic and non-glycaemic carbohydrates (sugars and fibre), potassium, folates, calcium, thiamin, niacin, vitamin B_6, phosphorus, magnesium, copper, riboflavi, pantothenic acid and a variety of phytochemicals. In addition, citrus contains no fat or sodium and, being a plant-based food, no cholesterol. The average energy value of fresh citrus is also low (see the below table), which can be very important for consumers concerned about putting on excess body weight. For example, a medium orange contains 60 to 80 kcal, a grapefruit 90 kcal and a tablespoon (15 ml) of lemon juice only 4 kcal.

- Besides consumption of citrus as fresh fruit, a large number of products and byproducts are made from them. Citrus peel is used as a flavoring agent and insect repellent, and for its medicinal, antiseptic and aromatic compounds. Citrus peel is rich in pectin, cellulose and hemicellulosic polysaccharides, which can be hydrolyzed into sugars and fermented into alcohol or ethanol (fuel).
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Nutritional Facts about Citrus Fruit

	Orange	Grapefruit	Mandarin
Weight *(g)*	131	236	84
Energy *(kcal)*	62	78	37
Fibre content *(g)*	3.1	2.5	1.7
Ascorbic acid *(mg)*	70	79	26
Folate *(mcg)*	40	24	17
Potassium *(mg)*	237	350	132

Analysis of Kinnow:

VALUE OF KINNOW

Chemical Composition of Kinnow when Ripe and Ready for Consumption.

Juice %	47.5
Vit. C.(mg/100ml)	32
Calcium (mg/100ml)	40
Phosphorous (mg/100ml)	18
Iron (mg/100ml)	0.45
Reducing sugar percent	3.75
Non reducing sugar percent	3.65
TSS %	12
Sugar %	9
Acidity %	1
TSS/Acid ratio	10

Importance of Kinnow:

Citrus occupies an important position among fruit in Pakistan. It accounts for about 40 percent of total production of all fruit in the country, and is grown on around 193,977 acres. In 2011-2012, Pakistan produced 2.1 million tons of kinnow. Among various species and cultivars, kinnow has a distinctive position in Pakistan. Pakistan accounts for over 90 percent of world total production of kinnow – Citrus reticulata variety (FAO, Stats).

PRODUCTION OF FRUIT – PAKISTAN

(Tons)

	2007-08	2008-09	2009-10	2010-11	2011-12
Citrus	2,294,466	2,132,276	2,150,054	1,982,191	2,147,340
Total Fruit	7,136,627	7,008,151	6,930,476	6,926,583	6,796,818

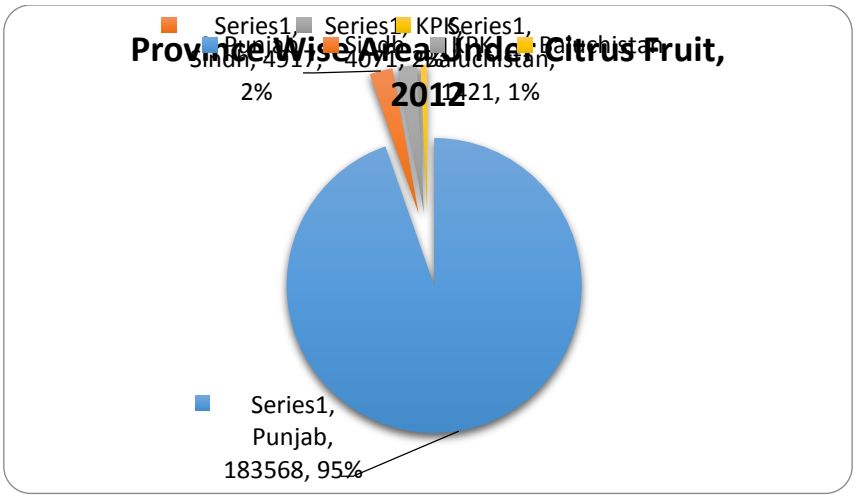
Citrus is grown in all four provinces of the country. In province Punjab, it is grown in several districts which include Sargodha, Sahiwal, Toba Tek Singh, Lahore, Sialkot, Jhang, Mianwali, Multan, and Gujranwala. In province KPK, six districts are known for this purpose: Mardan, Peshawar, Swat, Swabi, Noshera, and Hazzara. Province Sindh has three districts (Sukkur, Khairpur, and Nawabshah) where citrus is grown and in province Balochistan, Mekran, Sibi and Kech are the three districts where citrus is grown (Pakissan.com, 2008)

Pakistani Output/Production Levels

Area Under Fruit-by Province

(Acres)

Pakistan	**193,977**
Punjab	183,568
Sindh	4,917
KPK	4,071
Baluchistan	1,421



Province Wise Area Under Citrus Fruit, 2012

Pakistan stands among the top ten mandarin growing countries in the world. Pakistan annually produces about 12.0 million ton of fruits and vegetables. Citrus fruit is leading in term of production followed by mango, dates and guava.

Punjab is the centre of production and supplies citrus fruits of high quality and grade. Areas under different varieties indicate that about 86 per cent of the citrus is covered by the Kinnow variety followed by Musambi (10 %), Feutral (4%)and Blood Red (1%).

Citrus (95% Kinnow)

Share in Total Fruit Production and Acreage (20011-2012)

	Production (Tons)	Area (Acres)
Citrus	2,147,340	193,977.0
Total Fruit	6,796,818	829,616.0
Citrus Share of Total (%)	31.59%	23.38%

Kinnow also tops the list of foreign exchange earners among the horticulture exports from Pakistan, contributing close to 148 million dollars (USD) to the country's foreign exchange earnings in 2012, and holds the number one position among all fruits both in area and production.

Global Citrus Production

Brazil and United States are the leading producers of citrus globally (Spreena, 2001). In Brazil, the state of Sao Paulo is the major producing center, and in the USA, Florida is the producion leader. See Table 10: Major producing countries of citrus.

Major producing countries of Citrus

Category	Major producing countries
Oranges	Brazil, United States, Mexico, India, Spain, China, Iran, Italy, Egypt, Indonesia.
Small citrus (e.g mandarins)	Nigeria, China, Syria, Guinea, Japan, Saudi Arabia, India, Sierra Leone, Angola, Tunisia
Lemons and limes	Mexico, India, Iran, Spain, Argentina, Brazil, United States, China, Italy, Turkey
Grapefruit	United States, China, South Africa, Mexico, Israel, Cuba, Argentina, India, Turkey, Tunisia

Source: FAO (2011)

Total world production of citrus increased by almost four times between 1961-2012, reaching 105 million tons during 2011 (FAO Stats).

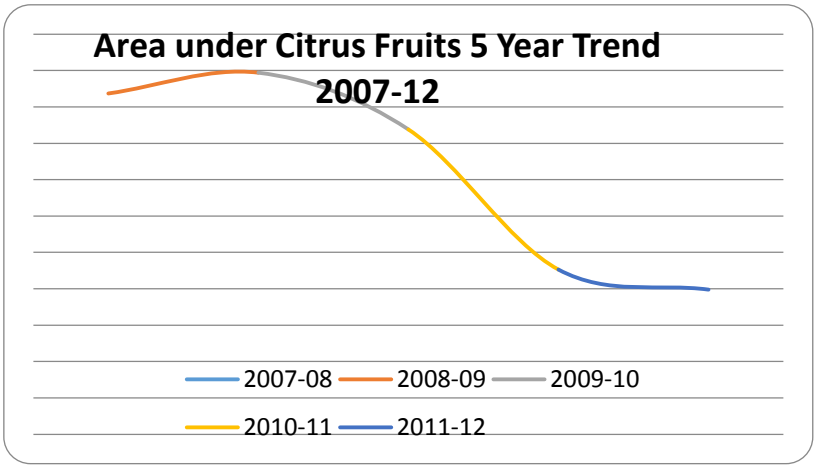
Citrus is grown in 140 countries. Latin America and the Mediterranean are the largest citrus producing regions. Citrus fruits include orange, mandarin, tangerine, grapefruit, pumelo, tangelo, citron kumquat, lime and lemon (FAO Stats).

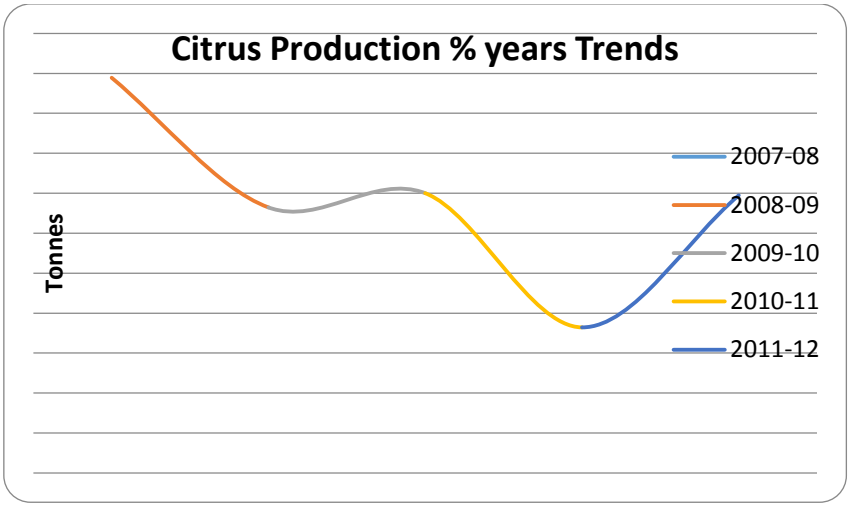
Pakistan Citrus Production Base:

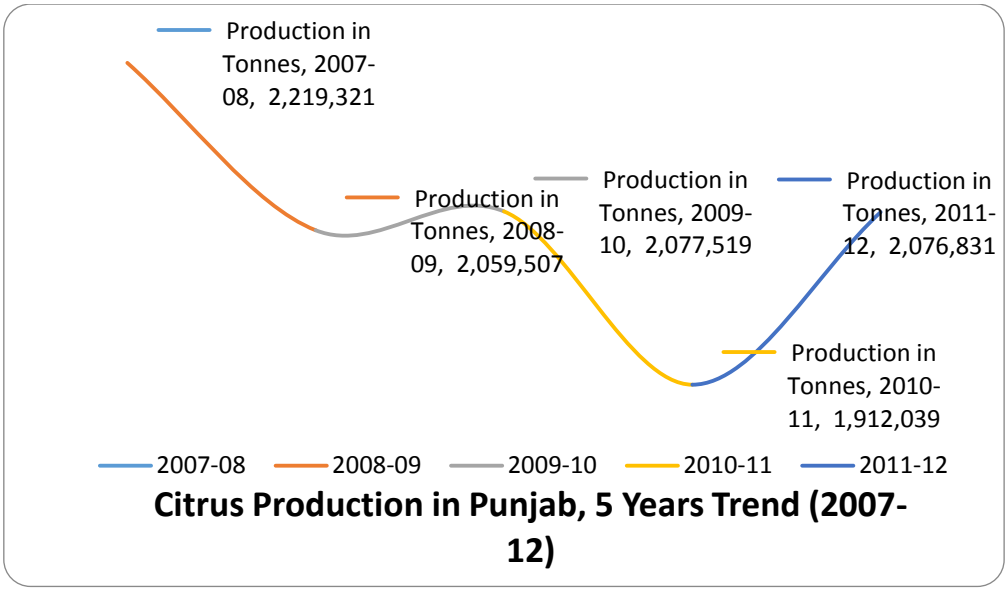
The following are the main commercial varieties cultivated in the country:
Succri, Mausami, Washington Navel, Jaffa, Red Blood and Ruby Red.

Sweet Orange	Valencia Late
Mandarins:	Feutrellas Early and Kinnow
Grape Fruit:	Mash Seedless, Duncan, Foster and Shamber
Lemon:	Eureka, Lisbon Lemon and Rough Lemon
Lime:	Kaghzi Lime and Sweet Lime

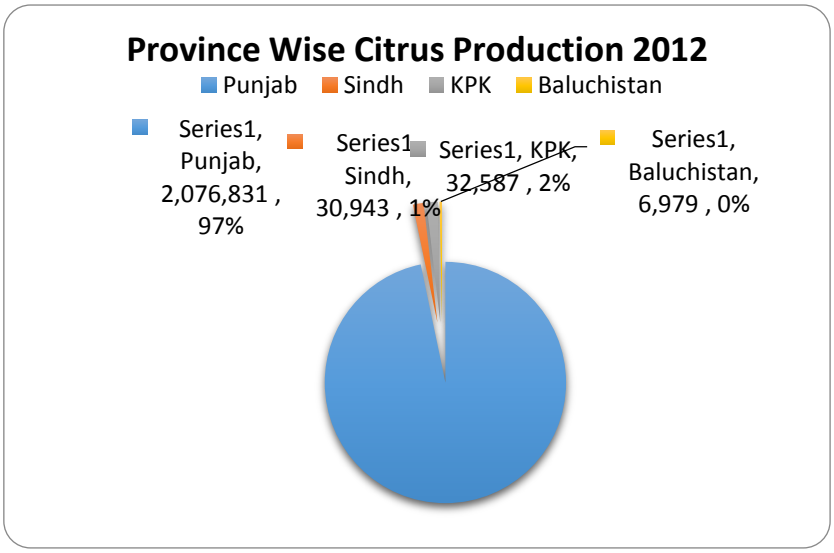
Statistics indicate that growth in citrus production in Pakistan has been uneven in recent years.







Province Wise Citrus Production (Tons), 2012	
Punjab	2,076,831
Sindh	30,943
KPK	32,587
Baluchistan	6,979



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Swat, Swabi, Noshera and Hazzara. The province of Sindh has three districts (Sukkur, Khairpur, and Nawabshah) where citrus is grown and in the province of Balochistan, Mekran, Sibi and Kech are the three citrus growing districts (Pakissan.com, 2008)

Punjab is the centre of production and supplies citrus fruit of high quality and grade. Areas under different varieties indicate that about 86 percent of the citrus is covered by the kinnow variety, followed by musambi (10 %), feutral (4%) and blood red (1%).

Table 5: Pakistan Province Wise Production Levels

	Area Under Production (Hectares)	**Production (Tons)**
Pakistan	**193,977**	**2,147,340**
Punjab	183,568	2,076,831
Sindh	4,917	30,943
KPK	4,071	32,587
Baluchistan	1,421	6,979

Crop Reporting Services of Provinces, Government of Pakistan

Several geographical regions in Pakistan, particularly the plains of the Punjab province provide suitable conditions for growing kinnow mandarins.

Sargodha Kinnow Production Cluster:

The Sargodha area is considered to have suitable conditions for this fruit including canal water and subsoil water availability suitable for agriculture, nitrogen content in the soil and relatively cool climate in the winter months. Due to demonstrated comparative advantage, Sargodha district has become the main kinnow production base in the country with about 650,000 tones of fruit each year. This study is confined to the largest producing clusters in district Sargodha.

The soil and climatic conditions in the Sargodha areas have given kinnow a flavor which distinguishes it from comparable mandarins grown in the world. The unique natural conditions are also considered to be responsible for a sweet and distinctive taste. Due to its texture, color, taste, aroma and flavor attributes, the kinnow from the area is well accepted among consumers in several markets.

A sizeable kinnow processing industry has developed in the last fifteen years. It is relatively well developed as compared to the processing of other fresh fruits in Pakistan. According to a recent survey by a UNIDO team under the TRTA program of the European Union, there are more than 220 kinnow processing enterprises in Sargodha with an installed capacity to wash, grade, wax and pack over one million tons for primarily export markets.

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Sectors' Potential:

Pakistan is the tenth largest producer of mandarins in the world (FAO STAT). It is the largest producer of the *Citrus Reticula* variety of citrus (mandarin category) commonly known as kinnow. Citrus area under production has increased to 486 thousand acres in the years 2011-2012 from 68.50 thousand acres in 1959-1960.

Pakistan's agro-climatic conditions provide a suitable environment for the production of Citrus, providing a strong comparative advantage as indicated by the sustained growth over the last four decades. In view of the availability of suitable agro-climatic conditions across several geographical areas in Punjab, particularly neighboring districts to the present production clusters, potential for further growth is recognized by experts and stakeholders. As the area under cultivation growth trends indicate, producing kinnows is profitable for the growers at the present level of productivity. The recent trends (last five years) in the area under cultivation however suggest that some growers could be finding other alternatives more attractive as compared to planting more kinnow orchards in the areas considered suitable for its production.

Several studies in the past have reported that a significant portion of produce (35% to 40%) was wasted due to various reasons (Ali, 2004, p. 251). During the assessment, it was learnt that significant improvement has taken place and in certain cases, the so called wastages have reduced to almost zero percent. A leading business house whose operations are integrated across production (orchard), processing and exports reported that due to better orchard management practices, three pickings (harvesting practices) as opposed to one in the past, and sale of C grade to citrus concentrate plants, they were utilizing almost 100% of the orchard produce. It was maintained that the chain had become more efficient for domestic supplies as the "beuparies" or local traders were buying B grade directly from growers/contractors/processors and selling to retailers in consumption centers. Due to opening of several export markets, the industry had more options to export different sizes and recover higher economic value from small size fruit as well, which was not possible in the past. Also, establishment of cold storage and higher local consumption has contributed to higher value realization. Another leading exporter stated in an interview that due to rising prices of inputs on one hand and relatively competitive prices in the export markets on the other, growers, processors and exporters were more conscious of the economic value wasted due to poor orchard management practices, careless handing and inappropriate transport and handling. According to him, there was sufficient room for further improvement in terms of realizing higher value for actors across the kinnow value chain.

Only about 10 percent of total citrus production of the country is exported. A study on price elasticity of kinnow, conducted by Haleem, Mushtaq, Abbas and Sheikh (2005) has reported price elasticity of citrus to be 1.48, which implies that increase in the export price of citrus is likely to give a considerable boost to the export. Currently, the export unit price of Pakistani kinnow is very low as compared to that of other citrus exporting countries; 44% of world average price for the mandarin category. This suggests that a substantial potential for export growth through improvement in quality exists.

Potential can be exploited through diversifying the markets of kinnow. Traditional markets for the Pakistani kinnow include Russia, Ukraine, Saudi Arabia, UAE, Philippines, Indonesia and Afghanistan. Several opportunities are available, and leading exporters are considering focusing their efforts for diversification into some African markets, besides neighboring SAARC countries like Bangladesh and Sri Lanka. Exporters are also considering focusing on Hong Kong, Singapore, Malaysia and other markets in the Far East to have a broad base for their product.

From the cost of production table (Table 6) below, it is evident that Kinnow orchards are profitable for growers at the going market prices and yield levels. Feedback from the growers strongly suggests

that the profitability has eroded on account of higher input costs, decline in quality mix of harvest and harvest contract value. Many believe that the trend will continue if the farm practices are not improved to arrest incidence of disease, and export markets are not diversified to achieve more stable and higher prices for the product.

Table 6: Kinnow Cost of Production Small Growers in 2013

Kinnow Cost of Production Small Growers

Cost of Production of Citrus		Kinnow			Small Growers
Acres	**1**				
Item	**Description**	**Unit**	**Qty**	**Price (PKR/Unit)**	**Amount (PKR)**
Value of Production					
Output Unit	**# of Output Units**	**Ave Wt per Output Unit**	**Total Output Weight per Acre**	**Ave Rate per Unit**	**Revenue per Acre**
Tons			4.5	20,000	90,000
Total Gross Income					
Operating Expenses					
Net Operating Profits					
Cost of Production					
Land Preparation					
Ploughing	Ploughing (with different Ploughs)	No. of Ploughing	3	600	1,800
Planking	Plankings after Ploughing	No. of Planking	2	600	1,200
Ridging	Ridge making for seed sowing	No. of Ridging	1	1,000	1,000
Laser Leveling	Land Leveling	No. of Ops	0		-
Plant Sowing					
Plantlets	Amount of Seed used	Bags/Acre	100	100	10,000
Treatment	Seed treatment with Chemicals	No. of Ops			-
Planting Expenses	Machine or manual sowing	No. of Ops	1	1,000	1,000
Fertilizer					
Urea	Bags of Urea Fertilizer used	No. of Bags	1	1,800	1,800
NPK	Bags of DAP Fertilizer used	No. of Bags	1	3,200	3,200
SOP/MOP	Bags of Potash Fertilizer used	No. of Bags	1	4,500	4,500
Zink	Bags of Zink used for crop	No. of Bags	1		-
Other	Bags of Other Fertilizer used	No. of Bags	1		-
Plant Protection					
Weedicide spray	Weed Control	No. of Sprays	0	800	-
Pesticide spray	Insect/Pest Control	No. of Sprays	2	600	1,200
Fungicide	disease control	No. of Sprays	0		-
Crop Irrigations					
Tube-well Irrigations	Tube well Irrigations for whole crop period	No of Irrigations	3	800	2,400
Canal water Charges	Fixed Canal Water charges for crop period	Acre	1	250	250
Harvesting					
Harvesting by Labor	Charges for Using Harvester	Acre	1	2,500	2,500
Picking Labor	Charges for Picking	Acre	0	3,500	-

	and filling				
Transportation					
Transportation	Transporting farm to the Factory	Acre	1.5	130	195
Miscellaneous	Any other Expenses	Acre	1	300	300
Total Variable Cost of Production					**33,250**
Land Rent(For Crop Period Only)	Land Rent/Lease for crop period(Months)	Acre	35000	1	35,000
Labor Charges	Ag-Labor Charges for crop	Acre	1		-
Depreciation	For Ag-Machinery/Buildings	Acre	1		-
R & M	For Ag-Machinery/Buildings	Acre	1		-
Total Other Expenses					**35,000**
Total Expenses					**68,250**
Net Income Per Acre					21,750
Total Income (All Acres)					21,750

In comparison, medium and large growers are earning higher returns from their existing orchards. It has been learned that the difference is coming from the application of better farm inputs, especially plant protection chemicals. As evident from the table below, profitability for medium and large growers is higher for progressive medium growers.

Cost of Production of Citrus

Citrus **Medium Growers**

Acres	**1**

Item	**Description**	**Unit**	**Qty**	**Price(PKR/ Unit)**	**Amount (PKR)**

Value of Production

Output Unit	**# of Output Units**	**Ave Wt per Output Unit**	**Total Output Weight per Acre**	**Ave Rate per Unit**	**Revenue per Acre**
Tons			5.0	21,000	110,000

Cost of Production

Land Preparation

Ploughing	Ploughing (with different Ploughs)	No. of Ploughing	4	600	2,400
Planking	Plankings after Ploughing	No. of Planking	2	600	1,200
Ridging	Ridge making for seed sowing	No. of Ridging	1	1,000	1,000
Laser Leveling	Land Leveling	No. of Ops	0		-

Plant Sowing

Plantlets	Amount of Seed used	Bags/Acre	100	100	10,000
Treatment	Seed treatment with Chemicals	No. of Ops			-
Planting Expenses	Machine or manual sowing	No. of Ops	1	1,000	1,000

Fertilizer

Urea	Bags of Urea Fertilizer used	No. of Bags	2	1,800	3,600
DAP	Bags of DAP Fertilizer used	No. of Bags	2	3,850	7,700
SOP/MOP	Bags of Potash Fertilizer used	No. of Bags	2	4,500	9,000
Zink	Bags of Zink used for crop	No. of Bags	1		-
Other	Bags of Other Fertilizer used	No. of Bags	1		-

Plant Protection

Weedicides spray	Weed Control	No. of Sprays	2	800	1,600
Pesticide spray	Insect/Pest Control	No. of Sprays	3	600	1,800
Fungicide	disease control	No. of Sprays	4	750	3,000

Crop Irrigations

Tube-well Irrigations	Tube well Irrigations for whole crop period	No of Irrigations	6	800	4,800
Canal water Charges	Fixed Canal Water charges for crop period	Acre	1	250	250

Harvesting

Harvesting by Labor	Charges for Using Harvester	Acre	1	2,500	2,500
Picking Labor	Charges for Picking and filling	Acre	1		-

Transportation

Transportation	Transporting to the Market	Acre	100	15	1,500
Miscellaneous	Any other Expenses	Acre			-
Total Variable Cost of Production					**51,350**

Land Rent(For Crop Period Only)	Land Rent/Lease for crop period(Months)	Acre	1	35,000	35,000

Labor Charges	Ag-Labor Charges for crop	Acre	1		-

Depreciation	For Ag-Machinery/Buildings	Acre	1		-
R & M	For Ag-Machinery/Buildings	Acre	1		-
Total Other Expenses					**35,000**

Total Expenses	**86,350**
Net Income Per Acre	**23,650**
Total Income (All Acres)	**23,650**

It is evident from the above cost of production data that medium and large growers are making higher profits per acre as compared to small growers.

The cost of production scenario is further validated with cost of field operations data under a project implemented by leading growers of Bhalwal area with the help of a donor funded project. According to the 2013 data, there is not much difference in rupee terms between the practices followed by progressive farmers as compared to other growers who are following conventional practices. This also signifies that the gap exists in awareness and the adoption of practices recommended by extension services.

Cost of Field Activities / Acre (For Kinnow) 2013, Sargodha Area

Sr. No	Application Month/Timing	Field Activities/Practices	Detail	Cost Per Acre
1	December	Farmyard Manure (Compost) Application	4 Bags/Acre	3,200
2		Pruning (Removal of dead Branches)	Each Acre	2,200
3	January	Mealy Bug Spray (Insects)	Cosset@400ml/Acre	1,000
4		Fungicide Spray After Pruning (Against Diseases)	500g/Acre	1,150
5	February	Fertilizer Application (NP+K)	Nitrophos@4 Bags/Acre Potash@2Bags/Acre	18,500
6	March	Insecticide Application Against insects	300ml/Acre	750
7		Fungicide + Insecticide Spray (Diseases & Insects)	500+400g/Acre	1,500

8 9	April	Fertilizer Application (N) Bordeaux Paste on Plants Stem	1 Bag Urea + 10Kg Zink Each Acre	2,500 1,200
10	August	Fungicide + Insecticide Spray (Diseases & Insects)	400g+300ml/Acre	1,400
11	September	Fertilizer Application (N)	1 Bag Urea/Acre	1,800
			Total Expense/Acre	**35,200**

II. Market Trends

Total world trade stood at US Dollar 4,320.22 million in 2012 for the products category defined under Harmonized code 080520. The category of products includes mandarins (tang and sats), Clementine's, wilkgs, sim citrus hybrids (fresh/dried) and Pakistani kinnow. In terms of total quantities traded, the volume of trade stood at 4,741.81 million metric tons in 2012.

Spain was the largest exporting country in the world in 2012 with exports worth USD 1,668,621 and 4,741,810 metric tons exported. China, Morocco and Turkey follow with USD 747,613, 349,702 and 349,702 and 819,141, 314,657 and 406,439 metric tons of products exported in the year 2012.

Domestic markets:

Kinnow is by and large sold to consumers in a traditional way. Most of the local consumption is fed through road side fruit shops and vendors in villages, small towns and even big cities.

Kinnow, along with other fresh fruits is also sold in fruit sections of department stores and super markets in major urban centers.

According to the traders, demand for the processed kinnows is increasing in the urban markets. Consumers are attracted to clean, shiny fruit and are ready to pay a premium for sorted, waxed kinnows as compared to the manually sorted product available in the market. The trend was confirmed by the purchasing staff at organized supermarkets like Metro Stores and Hyper Star Store. The relative size of market for processed and packed kinnow however is very small compared to kinnow sold the traditional way.

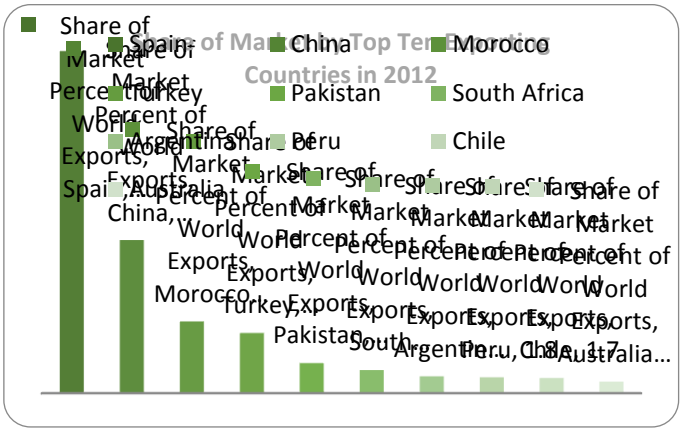
Export Markets:

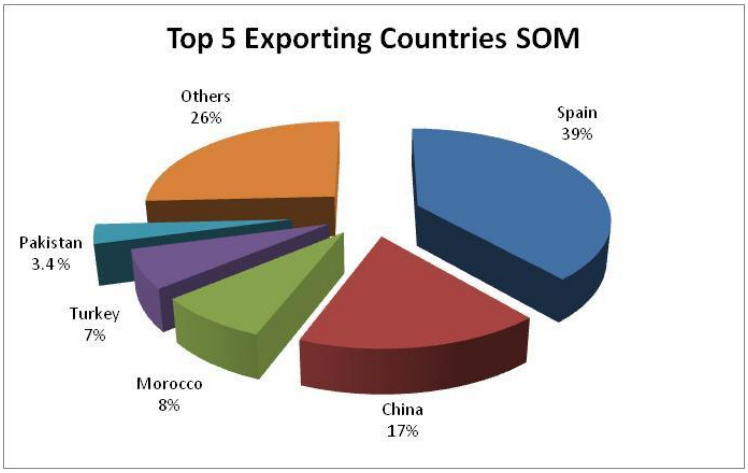
The table below depicts share of world market by 10 leading exporting countries in 2012

Rank	Exporters	Value Exported in 2012 (USD thousand)	Quantity Exported in 2012	Unit Value (USD/unit)	Annual Growth in Value between 2008-2012 (%)	Share in World Gxports (%)
	World	**4,320,217**	**4,741,810**	**911**	**6**	**100**
1	Spain	1,668,621	1,670,512	999	-1	38.6
2	China	747,613	819,141	913	23	17.3
3	Morocco	349,702	314,657	1111	1	8.1
4	Turkey	293,091	406,439	721	12	6.8
5	**Pakistan**	**147,723**	**367,922**	**402**	**32**	**3.4**
6	South Africa	112,773	122,058	924	14	2.6
7	Netherlands	88,999	76,815	1159	-7	2.1
8	Argentina	82,180	97,142	846	3	1.9
9	Peru	78,540	82,850	948	20	1.8
10	Chile	74,385	57,169	1301	26	1.7

The graph below (Chart 5) depicts share of market by Top 10 exporting countries as percent of total world exports, and the pie chart (Chart 6) signifies dominating market position of top five countries in the world. Pakistan is relatively a smaller player with 3.4% share of market.

Chart 5: Share of Market by Top Ten Exporting Countries in 2012





In terms of increasing export revenues, Pakistan is one of the fast growing mandarin exporting countries in the world. It achieved the highest annual increase of 32% between the years 2008 and 2012. Chile, China, Australia, Peru, Israel and Greece follow the with 26, 23, 20, 20, 19 and 19 percent annual increase in the corresponding last five years.

World's Fastest Growing Exporting Countries

Exporting Country	Value Exported in 2012 (USD thousand)	Annual Growth in Value Between 2008-2012 (%)	Quantity Exported in 2012	Annual Growth in Quantity Between 2008-2012 (%)
World	**4,320,217**	**6**	**4,741,810**	**5**
China	747,613	**23**	819,141	5
Turkey	293,091	12	406,439	9
Pakistan	**147,723**	**32**	**367,922**	**16**
Peru	78,540	20	82,850	16
Chile	74,385	**26**	57,169	**24**
Australia	57,470	20	35,279	**12**
Israel	54,533	19	47,913	**11**
Greece	51,976	19	84,545	**26**
Montenegro	470	44	793	35

As Table 10 above shows, Pakistan with 32% annual growth rate between 2008 and 2012, was one of fastest growing exporting countries for the product category. Due to faster average growth than that of the world, Pakistan's share of world market has increased from 2.1% in 2008 to 3.4% in 2012. This strong export growth has also strengthened Pakistan's Revealed Comparative Advantage (RCA) Index, which increased from an already strong 11.3 to 25 over the same period. The RCA index focuses on the concept of comparative advantage, accounting for the relative efficiency of producing different goods in the home country compared with the rest of the world. The RCA denotes relative efficiency indirectly, based on trading patterns that emerge from actual market transactions. It must not be confused with a competitive advantage- which requires many other elements to be in place—including appropriate marketing links and input supply channels, financing mechanisms, uniform product quality, and many other demand requirements. In other words, comparative advantages can be built into competitive advantages. An RCA greater than 1.0 indicates a comparative advantage for that item, while an RCA lower than 1.0 identifies a comparative disadvantage.[1]

Table 11: Pakistan Kinnow Revealed Comparative Advantage (RCA)

	2008	2009	2010	2011	2012
Pak Kinnow RCA	11.3	13.7	17.6	20.1	25.0
World Market Share (%)	1.44	1.96	2.50	2.84	3.42

[1] While a useful tool, RCAs are imperfect because they also embody government policies and institutions that may be distorting markets and like many indicators, account for only past performance. As long as these imperfections and limitations are recognized, RCAs can be helpful as analysis tools, since data are generally available in the trade record to gauge comparative advantage.

Source: Calculation based on ITC Trade Map Data 2013

However, Pakistan realized an average unit price of USD 402 per metric ton in the year 2012, which is the lowest per unit price among the top exporting countries, and in absolute terms represents only 44% of the world average per unit price.

Chart 7: Pakistan Kinnow Unit Export Prices as percent of World Average Unit Price of Mandarin Category in 2012

Source: ITC Trade Map, 2013

World Imports:

The Russian Federation was the largest importing country in the world in 2012 with imports worth USD 747 million and 762,787 metric tons, with a world market share of 16.4%. This market is followed by France, Germany, the United Kingdom and the United States, with global market shares of 9.4%, 8.5%, 6.9% and 4.9% respectively.

World's Top 10 Import Markets for Mandarin Category, 2012

Rank	Importers	Value Imported in 2012 (USD thousand)	Quantity Imported in 2012	Unit Value (USD/unit)	Annual Growth in Value Between 2008-2012 (%)	Share in World Imports (%)
	World	**4,548,820**	**4,687,504**	**970**	**7**	**100**
1	Russian Federation	747,013	762,787	979	19	16.4
2	France	427,656	361,090	1184	0	9.4
3	Germany	386,154	357,528	1080	2	8.5
4	United Kingdom	312,658	264,280	1183	0	6.9
5	United States of America	222,016	144,138	1540	2	4.9
6	Netherlands	217,493	195,670	1112	2	4.8
7	Canada	179,951	129,915	1385	4	4

8	Indonesia	176,568	179,394	984	13	3.9
9	Ukraine	159,334	175,715	907	20	3.5
10	Poland	124,276	157,267	790	-5	2.7

Beyond being the largest market, it also has registered one of the highest growth rates in the top 10 importers list. With 19% growth p.a. over the last five years, it is surpassed only by Ukraine, which grew at 20% p.a. but form a much lower base. The table shows that European markets, as well as Canada and the US, purchased this type of fruit for much higher average prices- ranging from USD 1,112 per ton in the Netherlands to 1540 per ton in the USD, as opposed to the USD 979 on average in the Russian Federation.

The industry is of the view that the higher prices are primarily due to seed less clementine varieties (which Pakistan is not currently producing) that are produced by Spain, Morocco, Turkey and other Mediterranean countries. In other words, Pakistani kinnows get much lower prices due to high number of seeds in the fruit. Leading exporters are of the opinion that shifting to less seeded or seedless varieties may enable much higher prices (30-40% higher than the existing levels) since other product attributes like aroma, flavor and taste are unique for Pakistani kinnows and liked by consumers in several important markets.

In summary, the world market for kinnow is growing at a healthy rate, and Pakistan has been able to increase it world market share. Nevertheless, the average prices it obtains in the world market are less than half the world average. Among the highest growth markets, Indonesia and Ukraine may be of immediate interest for Pakistani exports as they are already purchasing a significant amount of Pakistani kinnows and their overall market has registered double digit growth in the past five years. The more lucrative, but stagnant European and North American markets may require the introduction of a different variety.

Table 13: Pakistan Exports in 2012

Export Markets- Pakistan	**Share in Pakistan's Exports (%)**	**Unit Value (USD/unit)**	**Share of Partner Countries in World Imports (%)**	**Total Import Growth in Value of Partner Countries Between 2008-2012 (%, p.a.)**
Total Pak Exports	**100.00**	**402.00**	**100.00**	**7**
Afghanistan	47.10%	410.00	1.5	114
Russian Federation	24.40%	530.00	16.4	19
Ukraine	5.98%	519.00	3.5	20
United Arab Emirates	5.68%	290.00	0.6	20
Indonesia	2.76%	399.00	3.9	13
Saudi Arabia	2.62%	300.00	0.5	9
Iran (Islamic Republic of)	2.49%	413.00	0.1	-16
Philippines	1.83%	432.00	1.2	44
Sri Lanka	1.25%	287.00	0.1	32
Bangladesh	0.97%	340.00	0.5	186

Source: ITC Trade Map, 2013

Analysis of trade statistics show that Pakistan's export to its top two trading partners for the product was over 71%. Exports to top five countries was approximately 86% and the country exported over 95% to top ten countries. The analysis indicates that Pakistan's exports of kinnow are highly dependent upon few markets. The narrow base indicates a risk inherent in the country's lopsided portfolio.

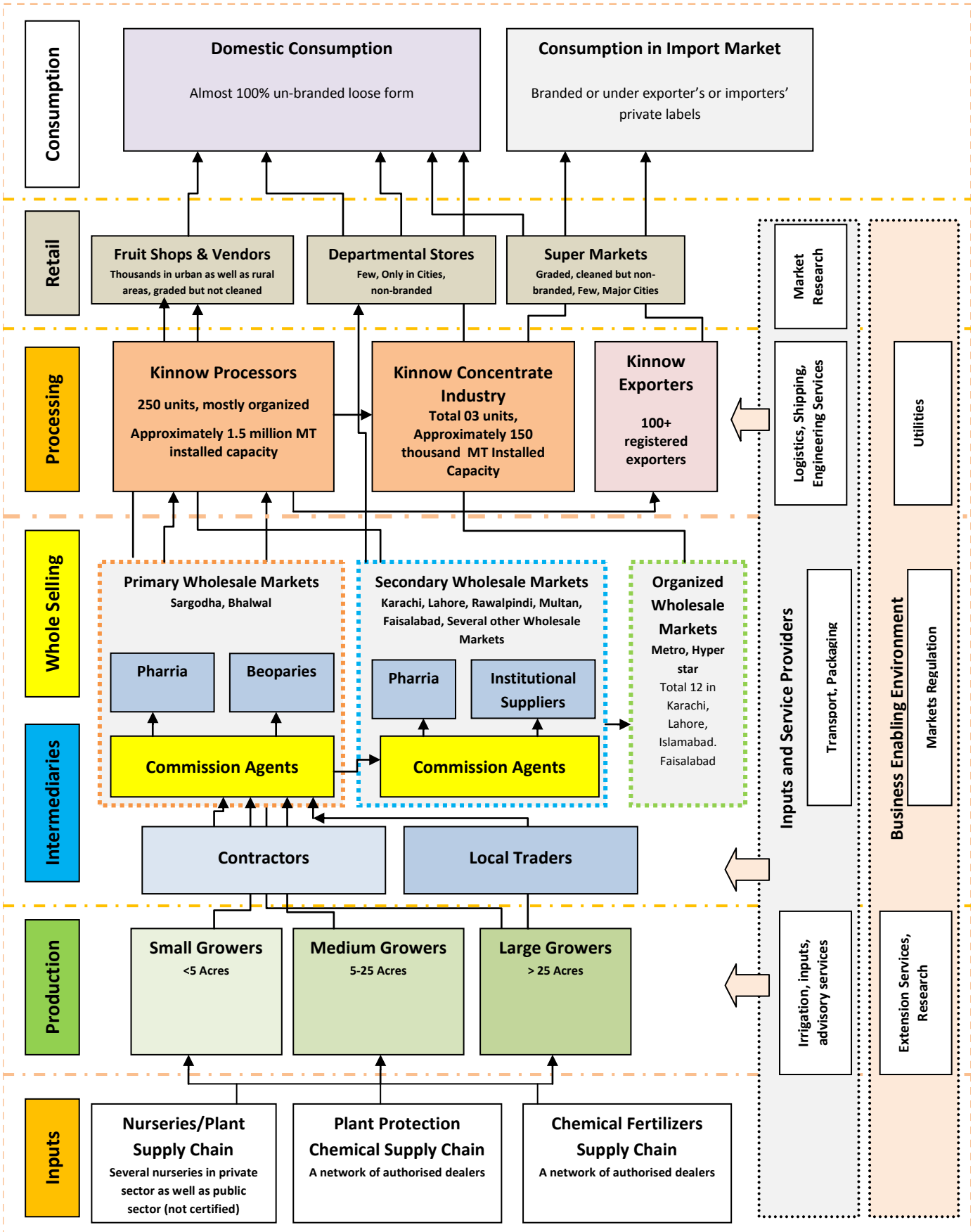
III. Structure of the Kinnow Value Chains:

Kinnow value chains are comprised of the following participants and actors:

- Input Suppliers (fertilizer, pesticide etc)
- Growers
- Contractors
- Commission agents
- Resellers
- Traders
- Processors
- Exporters
- Citrus Concentrate Processors

The map below depicts the flow of goods across the chain:

Value Chain Map Kinnows



Input Providers:

An elaborate presence of input providers exits in the kinnow producing areas. Every town has multiple dealers of fertilizers. In addition to authorized dealers of fertilizers and pesticides who sell as per the policies of their principals, there are many who buy in whole sale quantities and retail (small) quantities. These dealers also sell on credit to small growers who usually are short on finances. In addition to dealers' network, inputs are also provided by commission agents in the wholesale markets. The mode of payment usually is credit and commission agents usually charge marked up prices for the inputs they provide.

Due to proliferation of plant protection chemical brands/labels, growers find it difficult to differentiate between quality products and substandard ones. Availability of standard products is reported as an issue by growers.

Similarly, there are many stories of cheating growers by selling counterfeit products by fertilizer as well as pesticide dealers.

There are serious implications of substandard and counterfeit fertilizers and plant protection chemicals for kinnow growers as well. Many experts believe that incidence of disease has increased due to ineffectiveness of these chemicals. They also claim that some of the pathogens have mutated due to in appropriate application of broad spectrum pesticides and therefore several insect pests have developed resistance against plant protection chemicals available in the market.

In order to ensure that adulteration does not take place at the retail level and that counterfeit products are not sold under established brands, many leading input marketing companies have established their own networks of franchise outlets. The franchise outlets are gaining popularity with growers who buy with cash and who have had unsatisfactory experience with the non-branded or conventional input dealers in the past.

On the other hand, the number of private dealers runs in the hundreds in the citrus producing areas alone, and a proliferation has been observed over the last few years. This is attributed to heavy profits available to the dealers by selling products of un-known brands or labels, or counterfeit products of popular brands.

While leading brands of fertilizers and other inputs are trying to create awareness among growers and also trying to increase availability of standard products through their franchise networks, the problems due to sale of substandard inputs is on the rise. Growers complain that they incur heavy losses due to substandard products. They also complain that at times government extension staff collude with sellers of substandard products and try to influence purchase decisions in favor of substandard products in exchange for gains offered by these companies.

An industry leader The held Department of Agriculture responsible for the prevailing situation. He questioned the wisdom of the provincial government to approve hundreds of labels in the first place. He also expressed deep concern over the capacity of the government to ensure that the licensed producers were packing as per the standards and counterfeits were not selling in the market place.

Structure of the Production (Kinnow Orchards):

Kinnow Orchard is the production house where fruit is produced. There are two major stakeholders involved at the farm level, the farmer/owner and the contractor. Typically, the owner of the farm manages all the farming activities at the farm but does not involve in the marketing of his fruit in the market. Since harvesting and marketing are capital intensive operations involving market risk, the farmer minimizes this risk and leases his farm to a marketing contractor at a wholesale price prior to the start of the harvesting season. However progressive farmers, having capital investment, tend to harvest and market the farm produce by themselves.

The contractor (pre-harvest contractor) is responsible for the harvesting, post harvest operations, packaging, logistics and marketing of fruit in various fruit markets across the country. A typical marketing contract would have a lump sum fruit value to be paid in one to three installments to the owner. Usually one installment is paid in advance at the time of the contract while the rest are to be settled during the harvesting of the fruit. Estimated yield of the fruit, anticipated future price of the fruit and the estimated harvesting cost are the main drivers of the wholesale contract value. Depending on the risk averseness and the cash requirement of the owner, the marketing contracts are sometimes done years in advance with all the farming and harvesting operations to be carried out by the contractor as well. A higher upfront advance payment normally results in a lower overall lease value of farm.

The contractor either invests his own equity in the lease contract or borrows this amount from the broker of the fruit market. Some of the harvest contractors are the leasing agents of the fruit brokers who lease the farms on behalf of the brokers *(Aarhtis)* without investing their own equity. They supervise the entire harvesting and marketing activities managed through contract labor and earn a commission on the profitable sale of the farm. Since the capital is invested by the broker, a contractor is bound to sell his fruit to his brokerage house (trading shop in the *Mandi*) at his terms; including commission rate. The same is true for the farmer who sells his produce to the brokers from whom he has borrowed any loans to support his farming activities. Thus, at the farm level, the stakeholder who has investment capacity tends to benefit the most from the activity.

Structure of Marketing Channels:

As about 50% of kinnow is grown in Sargodha district; the fruit markets of Sargodha and Bhalwal towns are major primary markets of kinnow. Farmers, contractors, commission agents, traders, exporters and retailers are the main players of the market. Farmers and contractors sell the produce to traders through commission agents. The traders of these primary markets target the following market segments:

- Assembly or village markets
- Primary wholesale Markets
- Secondary or terminal markets in other towns of Pakistan
- Local retailers
- Fresh fruit processors/ exporters
- Juice concentrate processors

Assembly or Village Markets:

These markets exist in villages and small towns, close to the farms. Usually these markets cater to the needs of local retailers who usually have roadside assembly and sale points during the harvesting season. These points also act as assembly points for aggregating small lots of fruit to take to either primary markets or the secondary wholesale markets.

Primary Wholesale markets:

As about 50% kinnow is grown in Sargodha district, fruit markets of Sargodha and Bhalwal towns are major primary markets of kinnow. Farmers, contractors, commission agents, traders, exporters and retailers are the main players of the market. Farmers and contractors sell the produce to traders through commission agents. The traders of these primary markets target the following market channels:

Main Players in the Wholesale Markets:

There are three main players who manage the fruit marketing in wholesale fruit markets:

- The Brokers or Commission Agents *(Aaarhtis)* are responsible for the auction of the fruit.
- Resellers *(Phariya)* purchase fruit in bulk at auction through brokers and resell them to the local retailer.
- Distributors *(Ladaniya)* purchase fruit in bulk at auction through brokers and distribute it to secondary markets to be sold to resellers and retailers in secondary markets.

Commission Agent (Aarthi)

A broker or a commission agent holds a fruit and vegetable trading license issued by the local market committee and is supposed to facilitate the sale and purchase of the fruit. His clients are the sellers (grower/lease contractors), the buyers/resellers *(Phariya)* and the distributors *(Ladaniya)*. Since a typical fruit auction entails bulk quantities in multiple lots, only the resellers and the distributors participate in the auction. The broker makes a commission as a percentage of the sale price of fruit charged from the seller and fixed fee per crate from the purchaser. While the maximum commission to be charged from the seller is generally fixed by the market committee in consultation with the brokers (normally 6%), the actual commission charged varies from broker to broker.

Brokers are the major capital investors themselves and therefore dictate the commission terms. More than 80% of the market is driven on credit starting from the broker to the fruit retailer. In addition, credit is extended to the resellers and the distributors. On the supply side of brokers, they often give loans to the fruit contractors and sometimes to the growers who are then bound to sell their produce through them. Growers and contractors who have borrowed from the brokers are charged with higher commissions depending on the amount of money borrowed. These commissions generally vary from 6-15% and are not publicly disclosed. On the selling side, while the broker makes a flat per crate commission from the buyer, any credit sale is sold at higher rate, thereby making a higher margin for the broker. In the absence of a proper credit monitoring system, the brokers are also exposed to the credit risk and default.

Usually middlemen are not very popular in the chain. There is a strong perception in the minds of kinnow Value Chain actors that middle men exploit situations tor their advantage. Most of the middlemen are expanding their role to become fresh fruit processors, eventually hoping to become exporters themselves.

Reseller (Pharia):

The local reseller, called *Pharia,* purchases fruit in bulk from the broker (Commission Agent) in open auction lots and presents it for sale to retailers. He tries to get maximum credit from the broker to pass it on to his clients. His profits come from market appreciation and a premium on wholesale fruit prices. Fruit merchants (retailers) buy their daily requirement from resellers (*Pharia*) in small quantities. The retailer's margin comes from the type of transaction, cash discounts or credit premiums.

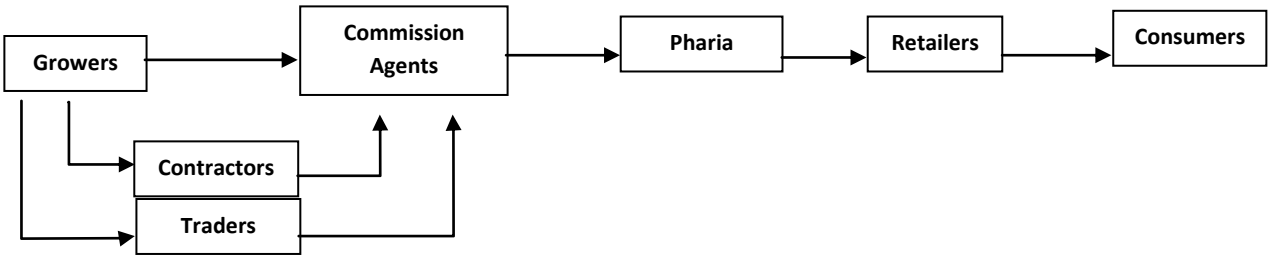
Distributor (Ladaniya) or Beopari:

Ladaniya is the distributor of fruit operating between primary and secondary markets. He purchases fruit from the broker in open auction from the primary wholesale market in multiple lots and sends it to secondary markets as a combined load for sale through commission agents of the secondary markets at a higher price. He pays for the transportation costs and takes risks of price fluctuations in the secondary markets. In the secondary markets, the commission agent uses brokers by paying 5% commission for selling fruit to local resellers who sell to retailers.

Secondary or Terminal markets:

These markets are generally located in big urban locations. Lahore and Karachi, Islamabad and Peshawar are prominent terminal markets in the country. kinnow produced in Sargodha reaches through three distribution channels to the consumers. It reaches the domestic consumers through commission agents and middle men.

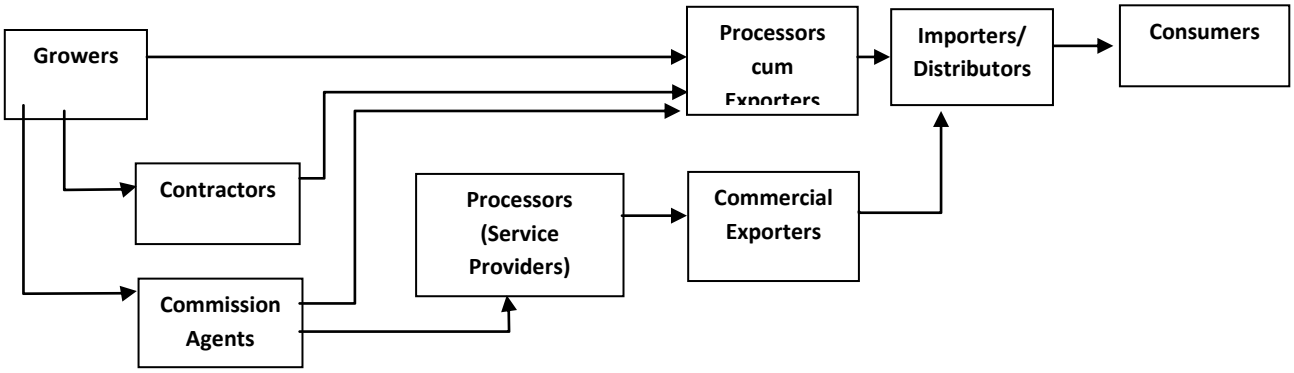
Value Chain # 1/Marketing Channel # 1: Local Supplies



Analysis of the value chain reveals that the average purchase price of kinnow ranges from Rs 14-22/Kg. The cost of picking is Rs 1/Kg and the cost of transport from orchard to the processing plant is also Rs 1.5/Kg. The average cost of processing, which includes washing, drying, waxing, grading and sorting is Rs 7/Kg. The cost of processed kinnow is between Rs 23-31/Kg, and the cost of packing is Rs 6-7/Kg. Therefore, the cost of kinnow after packing is Rs 29-38/Kg. After packing, the kinnow is sent to the cold storage. Cold storage on average costs Rs 1.5/Kg. The fruit is then sent to Karachi for shipment to the export destination. The cost of kinnow increases to Rs 52-63/Kg as it reaches Karachi. It might require short term storage at Karachi port, raising its cost to Rs 53 - 64/Kg.

The value chain losses indicates that 3 – 4% of the fruit is lost during picking and transport to the processing plant from the orchard. There is 8 – 10% loss of fruit during the processing. So in total 11 – 14% of the fruit is lost.

Value Chain # 2/Marketing Channel # 2: Exports

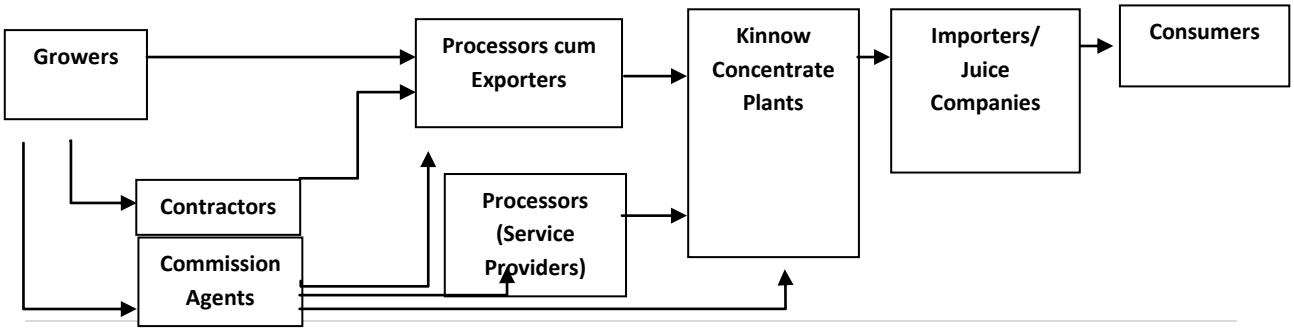


The 2nd channel supplies the exporter. The fruit is purchased by the processors. It undergoes processing i.e., washing, waxing, grading and packing and then it is stored in the cold storage for some time before it is transported to Karachi for shipment to the export destination.

There are two supply chains operating for exports. One is comprised of growers, processors along with exporters, importers and consumers in the end market. In a few cases, either the growers have forward integrated into processing and exports, or the other way around, where exporters have integrated backward to have both processing and production of kinnows. By far this is the shortest of all chains and most efficient for its participants. Industry leaders are following this model for its obvious benefit of control over quality for reliability and traceability, etc.

The other supply chain operating for exports is comprised of growers, contractors, commission agents, processors, commercial exporters and importers/distributors. Usually, commercial exporters are newcomers in the chain and processors are the ones who operate as a service provider either by choice or due to availability of excess capacity.

Value Chain # 3/Marketing Channel # 3: Kinnow Concentrate



Structure of the Fresh Kinnow Processing Industry:

According to a recent survey, there are over 220 processing units in Sargodha and Bhalwal areas. The majority of kinnow processors and exporters are also growers. Their export volumes are usually much higher than produce from their own fields. The dominant practice of processors and exporters is to get fruit for export from other orchards. The processors usually get fruit trough the mandi (commission agents). An estimate put this figure as high as 90% for the majority of processors. Some of the leading exporters who have become financially strong practice direct purchase from the growers. There is a growing trend among the top exporters to bypass mandi as far as possible due to usual difficulties they have experienced. High price uncertainty and inconsistent quality of produce are cited as the two most important reasons.

Generally, processing plants of exporters are well established, with in-house blast chilling and cold storage facilities, although the situation varies from plant to plant. The processing plants of top exporters have adequate human resources and management structures in place as well. According to a UNIDO survey under the TRTA program, of the top tier of processing plants, around 30 have quality management systems in place and have achieved certifications required either for market access or as per the requirements of their importers. As a result of an intervention by ASF under the ADP funded program, several leading processors in collaboration with growers also achieved Global GAP certifications few years ago. Leading exporters the consultant interviewed during the study regard that program as a success for several reasons. When asked why the program could not sustain itself once the subsidy was removed, they cited lack of commitment on the part of growers as the major reason because they started selling to mandi or other exporters rather than the processors they had agreements with. Processors were unable to get return on investments they had made with growers and generally shied away from making further contributions. A general lack of trust between the contracting parties became one strong factor.

Several leading processors have also acquired HACCP Certification apart from ISO 9000 certifications. This is indicative of management systems well established and functioning.

In most of the processing plants a single processing line is installed. The processing plants are fully developed for the processes of washing, sorting/grading, waxing, weighing, packing and stripping, and cool storage.

Besides the top tier processing plants owned by the leading exporters, the situation is different with the other 200 plus processing units that exist in area. According to an estimate, the overall installed capacity of 250 odd processing units is sufficient to process the entire production as such. According to an estimate by an industry leader, the overall kinnow processing capacity in district Sargodha is more than the production available, implying that an over capacity exists at the moment.

Most of the processing plants have 3-4 employees working around the year and about 100-200 employees working during the season, which begins in November and lasts till April. The processing factories which do not have their own cold storage facility sell their product to other processors who export or sell to the wholesalers from Baluchistan and NWFP. These wholesalers export kinnow to Iran, Afghanistan and the CIS states by road. The processed fresh kinnow is also sold to buyers from Karachi and Lahore who supply to the local market and also export.

It was learned from several industry sources during the assessment exercise that generally the situation is not comfortable for the small processing plants. Due to weak financial position, inadequate management systems and dependence on commercial exporters for the operation of their plants, their competitive position has eroded over the last few years due to low demand, competitive prices in export markets, high product prices and ever increasing operating costs. Industry experts fear a shakedown if 2013 also proves to be a tough year for the industry for the reasons cited above.

There is a dire implication for the kinnow exports and consequently for the entire value chain due to the prevailing over capacity situation. As Pakistan is exporting to only a few markets (Russia being the largest through sea shipments), many new exporters are compelled to sell in the same markets which have been served by their more established competitors. Since most of them end up competing on pricing in the absence of any unique selling point or product differentiation, there has been pressure on export prices from the last few years. Generally, many exporters end up piling up losses due to tight margins, an unfavorable supply situation unforeseen at the time of making export commitments or quality discounts "deducted" by the importers due to unsatisfactory product quality on arrival.

Due to price competition between exporters, the bargaining power has shifted to importers of Pakistani kinnows. In the light of this assessment, this consultant is of the conclusion that industry is itself responsible for the present situation it is facing. In the absence of any coordination among the exporters competing in a market, everyone is losing due to a situation where one Pakistani kinnow supplier is ready to sell at a lower price than the other irrespective of the demand situation in the target market. It is worth observing that the average unit price for Pakistani Kinnow was 44% of the world average unit price for the mandarin category. Unhealthy competition on the basis of price is believed to be the major cause for low unit price and consequently low profitability of the export value chain.

Juice Concentrate Processors:

USA and the Brazil are the largest citrus processing countries in the world. Sao Paolo (Brazil) and Florida (USA) account for around 85 percent of the citrus juice produced in the world. Around 99 percent of the citrus juice produced in Brazil is exported (Rodrigo, & Zacarias, 2006, p. 294).

Foreign companies like Citrus giant Cargill entered the processing industry in Pakistan in the nineties. Cargill sold its operations to its employees subsequently. The company, now called Citropak doubled it concentrate processing capacity in 2004, and is now producing other citrus based products. Another company, Fresh Juices Limited, is producing and exporting kinnow concentrate. Two more plants have recently come into production. It is estimated that four plants in total have over 50 tons per hour capacity (input weight) at the moment. It has also been learned that some foreign owned businesses have also expressed an interest in investing in the kinnow concentrate industry as they see potential due to raw material (C grade) availability at competitive prices from more than 220 fresh fruit processing plants working in the Sargodha area.

IV. Constraints affecting Value Chain Competitiveness:

Major constraints affecting value chain competitiveness are segregated into three categories. All factors affecting value chain competitiveness due to weaknesses at the enterprise level are segregated in one category. All those factors that affect value chain competitiveness because of poor cooperation or coordination among the value chain actors and poor institutional support are segregated under a 2nd category. Similarly, factors pertaining to an overall enabling business environment affecting value chain competitiveness are listed under the 3rd category. The purpose of segregation is to draw meaningful conclusions and propose recommendations for the relevant entities.

Constraints at Value Chain Actors' Level:

Weak management capabilities of value chain actors i.e. growers, contractors, processors and exporters are primarily responsible for eroding competitive position.

Essential inputs for kinnow growers are by and large available through an extensive franchise based dealer network, selling standard branded products of established international and national companies. Therefore, availability of standard products is not a key constraint.

At the production stage, most of the small growers are constrained due to:

- Lack of orientation/export culture
- Weak orchard management understanding and skills
- Limited use of modern technologies
- Weak management systems and skills
- Inadequate financial resources
- Poor understanding of buyers' requirements
- Small scale
- High cost of inputs due to purchase on credit, low price/contract value due to poor holding capacity or advances from commission agents

Processors:

Apart from 15-18 processors along with exporters who are generally more resourceful and equipped with systems to manage their operations well, most of the processors are constrained due to the following weaknesses:

- Lack of orientation/export culture
- Weak management systems and skills
- Weak processing management skills
- Limited use of modern technologies
- Inadequate financial resources
- Poor understanding of buyers' requirements
- High cost of inputs due to purchase on credit

Exporters:

Apart from 10-12 large exporters who generally have qualified staff and professional managers to manage their operations, many others have limited management capacities. Most of the exporters either lack essential understanding of product quality standards, market access related requirements or have inadequate knowledge/skills to cater to their buyers' needs. Some of the key weaknesses are:

- Lack of export orientation;
- Weak Quality Management Systems;
- Weak understanding on Supply Chain Management;
- Weak management control systems;
- Inadequate financial resources;
- Weak understanding of buyers' product requirements;
- Weak understanding on competing countries;

Constraints due to weak coordination/cooperation among Value Chain Actors and Weak Institutional Support:

Factors like unhealthy price based competition among exporters, and limited information sharing are affecting value chain competitiveness. The level of cooperation between growers and processors/exporters is weak. For instance the existing market system does not provide any incentive to growers to work for improving product quality and it does not provide any incentive to processors/exporters to cooperate with growers, although their mutual cooperation is imperative for the sustained growth of both. Commission agents make gains at the expense of other value chain actors due to their dominating role in the chain with the help of other associated market intermediaries resulting in a market that does not reward quality, increases market risks for growers as well as exporters and causes low return on investment /efforts to other value chain actors.

Institutional support is available however it is generally not helping to alleviate gaps or lessen constraints at the enterprise level; this is due to limited outreach, quality of advice and low credibility with value chain stakeholders.

Constraints Emanating from Business Environment affecting Value Chain Competitiveness:

Value Chain actors generally regard the overall business environment as not supportive or enabling for them. Several issues emanating out of poor regulatory regime or lack of enforcement persist to the disadvantage of a competitive kinnow value chain.

- Increase in cost of inputs like fertilizers and plant protection chemicals is a constraint for growers.
- Load Shedding and high energy cost;
- Sale of spurious or counterfeit fertilizers and plant protection chemicals and proliferation of private dealers selling unproven products.
- Lack of effective controls at the time of mandatory pre-inspection for the issuance of Phytosanitory/Quarantine Certificates, resulting in trust deficit on the part of the quarantine agencies in leading import markets for Pakistani kinnow;

V. Conclusions and Recommendations

Key findings and conclusions drawn on the basis of the analysis and assessments presented in the various sections above are summarized below.

Conclusions:

Pakistan's current export base is heavily dependent on Afghanistan and Russia. While world market trends point towards expansion of demand, Pakistan's exports, though expanding in volume, are not to high-end market segments. Pakistan's share in EU markets has decreased.

The value chain is losing its competitiveness due to several factors. Low yields, deteriorating product quality, seeded viziblity, weak supply chain management, inadequate facilities and weak management systems are reflective of weaknesses at the level of value chain actors.

Several weaknesses at the enterprise level are also reflective of poor cooperation among the value chain players and a less than supportive business environment. For instance, unhealthy price competition among the exporters indicates a weak cooperation among the exporters and a less than effective role of exporters' association. Similarly, it is concluded that limited sharing of information among stakeholders on matters of collective interest, poor advocacy with the government regulatory agencies and policy making institutions are reflective of weak cooperation among value chain actors.

Factors like lack of coherent strategy to curtail incidence of various diseases including Citrus Canker, knowledge gaps in development of seedless varieties and failure to develop high yielding kinnow varieties resistant to prevailing diseases are clear reflections upon the effectiveness of various value chain support organizations. Similarly weak understanding of exporters' on market access requirements, buyer requirements, management systems and importance of certification is also reflective of less than effective role of support agencies mandated and funded to support kinnow value chains. From the assessment of the prevailing situation, it is also concluded that poor technical skills of labor as well as staff working on farms, in processing units and with exporters generally are reflective of services provided by training service provides funded by government and donors. Poor knowledge on the part of growers to adopt good agriculture practices and awareness on product quality standards is reflective of extension services rendered by public sector extension services department.

It is therefore concluded that efforts are urgently required by individual value chain actors to work upon their respective weaknesses. More so there is an urgent need to improve level of cooperation among the kinnow value chain actors. Value chain support institutions need to enhance their effectiveness to provide support in areas which individual actors cannot manage at their level, as elaborated in the preceding sections of this report. Last but not the least, value chain stakeholders need to work with the government regulatory agencies through effective representation and one

voice to highlight irritants they are facing in the business environment and work towards alleviating the same.

VI. Constraints affecting Value Chain Competitiveness

In Pakistan yield per acre of citrus is generally lower as compare to developed citrus growing countries of the world. According to Agricultural statistics of Pakistan during the year 2006-07 average yield per acre was 7,921 kg which is lowest during the last ten years. Previous yeas remained almost constant at 9 thousand kg plus.

The above graph shows that during the last two decades yield per acre of Kinnow orchard does not show any significant improvement.

Yield of citrus in Pakistan is quite low as compared to that in Brazil, USA, and China. Average national yield of citrus in Pakistan is around 9,076 Kg per acre, while according to FAO Statistics of 2011 per acre yield of citrus is 15,165 Kg in China, 12,995 Kg in Turkey and 28,571 Kg in USA.

Pakistan is located at the same latitude as Florida and its acreage under citrus (Tangerine & Mandarin etc.) farming compares very favorably with that of Florida's bearing 382,900 acres. But Pakistan lag far behind Florida's in yield per acre. This lack of improvement can be attributed to a number of factors.

Various studies have listed several constraints faced by Kinnow value chains, especially export value chain. A study by CIAR had listed 14 constraints faced by Kinnow production and marketing systems in 2008.

1. Poor orchard and nursery practices,
2. Unreliable supply of certified seeds and bud wood,
3. Inefficient fruit production and irrigation practices,
4. Inadequate pest and disease management strategies (Gummosis and canker disease),
5. Lack of cultivars and rootstocks,
6. Unavailability of seedless cultivar,
7. Overproduction and post harvest losses
8. Lack of coordination between Research, Education, Extension and Farmers.
9. Lack of cold storage facilities,
10. Dysfunctional research and extension system,
11. Small scale farming,
12. Pre harvest contract system (advance sale to middle men),
13. Disadvantaged growers with lack of knowledge, and
14. Literacy and access to information.

A comprehensive survey undertaken by CABI in 2010 also found most of problems as discussed in the ACIAR study.

This report attempted to assess the extent of the various constraints in 2013. An account of various constraints faced by value chain is synthesized below by segregating constraints and issues for each stage of the value chain for better understanding of the readers, as under:

Citrus production is considered a risky venture as its success largely depends upon several exogenous factors like weather and market situation. Around half of the respondents termed the citrus orchard management as risky but profitable.

Citrus growers identified seven leading problems which include availability of plants, poor quality, orchard management, market research, land ownership, land ownership, relationship with buyers and transportation facilities. Lack of marketing research emerged as top most problem followed by lack of transportation facilities as major problems of citrus growers. They were of the view that if these problems are addressed, citrus production can be substantially improved.

During the validation process, the consultant had detailed discussions with leading growers and processors on this aspect. Growers confirm that the present situation is not different from the one prevailing in 2010. They are of the opinion that risk has actually increased for the growers as well as contractors/processors in wake of ban imposed by the largest importer of Pakistani Kinnow in 2013. Also they perceive high risk for Afghanistan market due to anticipated departure of NATO forces from Afghanistan in 2014.

At the orchard or the production stage, following situations prevails:

The yield and quality of the crop is low compared to international standards. It is estimated that about 30% of the harvest is of a quality acceptable on world markets while another 20-25% though unsuitable for export, is of a quality acceptable to the top quality range of the domestic market. According to leading Kinnow processors cum exporters, if an overall up to 50% harvested produce can be selected for top segments of export and domestic markets; a viable proposition does exist for the processors. Anything below 50% would render the commercial operation unviable.

Leading processors and exporters also maintain that there is a dire need for better management practices at orchards to improve ratio of A & B grades from the overall quantities produced. According to them comparable international ratio is above 90%. A significant focus is required at the production level to keep the Pakistani Kinnows cost competitive in the export markets.

According to Dr. Waqar Ahmed, an expert on good agricultural practices, irrigation is one of the most crucial agronomic inputs that play a vital role in crop improvement. According to him, at present Citrus growers do not manage the orchards on scientific lines for water management and apply canal water or tube well water. The quantum of irrigation water applied is not based on crop requirements and does not correlate with the phenology of the crop and climate, but it is on the adapted cultural practices in the citrus growing belt. He states that it is a very well determined fact that citrus thrives better under low irrigation but frequent irrigations than over irrigation.(Horticulture Industry, University of California, Barkley). Growth sensitive periods to water shortage are flowering time (Feb/Mar), fruit setting and rapid cell multiplication (Apr/May). Again during cell elasticity stage (Sept/Oct) frequent irrigation is required to compensate the water deficit in the plant body during these critical stages of plant flush growth and fruit development and enlargement in befitting manners.

Secondly the farmers commonly practice inter-cropping mostly with fodder and wheat in the orchards for their food and feed security. In most of the cases flood irrigation is done in the whole field. Some farmers put basin round each tree with channels connecting basins so that irrigation of

fruits trees can be independent of the intercropped area between the tree lines which have different water requirements. However, all these methods are non scientific and result in a lot of wastage of water and also results in poor crop growth and ultimately yield.

There is a dire need to develop irrigation method based on evapo-transpiration (ETo) of the crop for various stages of fruit development and water use efficiency of the crop. Orchard floor management for the better utility of water with reference to soil texture has never been tried to suggest the application of irrigation in citrus. Deep ploughing and heavy irrigation alternatively to conserve the soil moisture "wattar" is a common practice in the area. This practice is deleterious for the plants as it cut the soft fibrous roots of the plant, thus leading to less absorption area for the next irrigation; also it causes the root infection leading to Citrus Sudden Death-CSD, now more common in young orchards. Similarly, addition of organic matter and use of organic or artificial mulching is not practiced for the citrus to increase the water holding capacity of the soil

At the present, only few orchards use precision irrigation systems like drip irrigation and micro sprinklers under the tree canopy. High density plantation coupled with HEIS is an alternative approach to save the water and enhance the fruit quality.

Non-availability of high yielding Kinnow varieties is considered as one of the root causes for low productivity/yield followed by poor orchard management practices. It is a well considered opinion among the experts interviewed that yield can be significantly improved by introducing new varieties with higher yield potentials. Growers are of the opinion that availability of disease free plants of a high yielding Kinnow variety is imperative for the future survival of the value chain as the yield as well as quality of harvest has declined substantially over the years. Also the ratio of “A and B” category has dropped to 30-35% of total harvest from 60-70% for most of the orchards in Sargogha and Bhalwal areas whereas the international bench mark (Morocco and Turkey is 90% of total harvest).

Increasing Cost of Inputs:

The CABI survey reported a substantial increase in global fertilizer prices. For example, average international market price (FOB) of urea (black sea) increased from mere US$ 79.3 per metric ton in 1999-2000 to US$ 255.8 per metric ton in 2006-07. During the corresponding period, average market price of DAP rose from US$ 153.5 per metric ton to US$ 320.8 per metric ton.

In the domestic market, the prices also rose following the same trends. For example, price of urea increased from Rs. 324 per bag of 50 kg in 1999-2000 to Rs. 1800 in 2012-13. Similarly, price of DAP surged from Rs. 632 per bag to Rs. 3500 during the afore-said period.

Similarly a sharp increase in the prices of other inputs has been experienced by Kinnow growers in Pakistan. There has been a 60% increase in cost of utilities over the last five years and similarly cost of fuel has witnessed over 100% increase in the last five years. These inputs are essential for Kinnow growers as they have to pump irrigation water using either electricity operated water tube wells or diesel operated engines (called peter engines) to energize pumps.

According to growers, high cost of utilities and inputs has squeezed their profitability in the recent years as they are not getting corresponding increase in price of their produce.

High Incidence of Diseases and Pests:

There are several pests and diseases which are common threats to the citrus farming in Pakistan. Diseases Pests include Aphids, Citrus Leaf Minor, Lemon Butterfly, Citrus Whitefly, Red Scales, and Foot Rot, and diseases are Withertip, and Citrus Canker (Pakissan.com, 2008). Citrus Canker is caused by the bacterium *Xanthomonas compestris. pv. citri* (Burhan, Sahi, & Ahmad, 2007, p. 1867).

Citrus Psylla is the brown colored insect. It attacks the leaves and branches which results in substantial reduction in yield. Citrus Leaf Minor also attacks the leaves, turning them curled and deformed. Lemon Butterfly mainly attacks the fresh leaves. Citrus Whitefly attacks the leaves sucks the sap and thus causes damage to quality and loss in yield. Red Scales are sucking type of insects and cause damage to Kinnow and sweet oranges. They are mainly prevalent in the province Punjab and have the capability to survive throughout the year. Foot Rot is a fungus. It attacks the roots of trees to such an extent that tree gradually gets dried.

Withertip is a disease makes the branches and fruits of the affected trees, gradually dry up. And Citrus Canker is a bacterial disease, which cause damage to leaves and the fruits by forming canker (like spots) on the leaves and stems, resulting into loss in quality and reduction in yield. Losses due to diseases, insects and pests are very high as discussed above.

Incidence of High number of Seeds in Pakistani Kinnows:

Average number of seeds in one Kinnow fruit was reported to be 12.2 as compared to 11.2 in case of musambi, 9.5 in feutral and 8.8 in succari by Khan (2006). Number of seeds found in Pakistani Kinnow, ranges from zero to 54, which are considered a major deterrent to consumption of Pakistani Kinnow especially in the European markets. Seedless citrus fruits from other competing countries are highly preferred over seeded variety Pakistan is exporting.

The Orange Research Institute, Sargodha has reported that a 'less seeded' (i.e. 2-4 pips) variety of Kinnow has been developed, however it is under the process of certification. It is reported that Citrus Research Centre, located at the University of California, Riverside has developed a seedless Kinnow variety. Many growers are hoping that with the help of University of California, a seedless variety will be introduced in Pakistan to fetch higher prices in the international markets in the due course of time. They were are not very optimistic about the efforts of Pakistani research institutions to develop a seedless Kinnow variety.

Shorter Harvest Period for Pakistani Kinnows:

Peak production season of Kinnow in Pakistan is from December to February. Therefore presence of Pakistani Kinnow in the world market is for relatively a brief span of time. In contrast competing countries like Turkey, Morocco, Brazil, USA and Spain have extended their harvesting period by introducing multiple varieties (early and late maturing) across various production regions. Product from the competing countries is available for up to 180 days as compared to 75 days for Pakistan.

Exporters are of the opinion that availability of different maturing varieties is important for the competitiveness of the value chain. Brief harvesting season also has implications for the processing plants as they remain idle for rest of the year. Their low capacity utilization affect their competitive position.

Application of pesticides to the citrus trees erodes competitiveness of the citrus fruits in the international market. One option to deal with such situation is to substitute the chemical pesticides with organic substitutes. At least intervention will help in transforming the citrus production from convention system to organic system. In this way, competitiveness of Pakistani Kinnow will substantially improve. The researchers need to look into the matter on how to propagate effective use of need in the PPM.

Quality of Harvesting Labor's Skills:

Contractors interviewed by CABI researchers had identified seven leading problems they were facing in 2010. The problems included load shedding of electricity, availability of skilled staff for packing, non-availability of good quality packing material, lack of farm management skills, lack of skills in marketing, lack of information about markets, and lack of negotiation skills.

Due to poor skills of the contract labor, a significant percent of fruit harvest is damaged (reported between 8-10%). Due to poor or careless handling, skin is damaged during the harvesting and transportation processes. This fruit otherwise may be fit for export and may get full economic value instead of selling at discounted rates.

During the validation process it was confirmed that all the above listed problems still existed. It was mentioned during the interviews and FGDs that lack of skilled labor was compounded over the time. An interesting dimension came into discussion that due to lack of awareness on part of the contract labor, diseases were transferred from one orchard to another as bio security of orchards was compromised due to use of same hand tools and same cloths (which catch disease during the picking, pruning processes).

Weak Sanitary and Phytosanitory Compliance Capacity:

Satisfying health and food safety requirements of import markets, has become a major challenge for Pakistani exporters. EU requirements are particularly strict for food safety. Sanitary standards in the developed world are driven by consumer demands and any kind of exemption from meeting them is not possible. Compliance is difficult and costly; it requires investment in laboratories, safety and management systems, and technical expertise.

To fulfill the SPS requirements of the developed countries, Pakistan needs compliance capacities on several food safety standards. Industry needs to train laborers/workers working in the processing plants and the farmers in the fields. Industry is facing a severe shortage of well trained technical staff that has capacity to understand and comply with food safety, SPS requirements. In addition management staff, well versed with SPS regimes of target countries is a must.

Although there are a couple of good inspection bodies present in Pakistan and have been providing necessary support to Kinnow exporters, sufficient capacities do not exist at the level of service providers and within the exporting enterprises. Pakistan lacks a proper pre-inspection system. Despite keen desire by leading exporters to strengthen capacities in this regards, they are facing difficulties due to institutional weaknesses on part of the designated public sector institutions dealing with animal safety, plant safety and food safety regulations. The exporters mentioned that Department of Plant Protection does not have enough staff capable of inspection. They are of the opinion that there is a an intense need to revise the acts and ordinances being implemented by the concerned ministry (Ministry of Food Security, after the devolution of Federal Ministry of Food and

Agriculture). According to the industry sources, weak performance of DPP is hurting Kinnow exports and causing hardships to exporters who are making efforts and investment to develop SPS related compliance capacities as country is earning a bad name due issuance of certificate by DPP without proper inspection of export bound shipments. Exporters maintain that DPP need to employ enough numbers of qualified inspectors having capability and authority to inspect the farms and processing plants according to the international standards and also supervisors which supervise the inspectors. Like similar institutions operating in other countries. Poor trust on part of the quarantine and food safety inspection authorities of importing counties like Russia has resulted in ban on import of Pakistani Kinnows.

As per UNIDO experts, an effective SPS management system also requires a policy making institute at the federal level, with provincial governments having the mandate of implementation. The implementation system should have inspectors at district and farm level for effective SPS management. Parallel to the SPS management system a strong food safety management and inspection system is also required.

According to TRTA survey, majority of producers, processors and exporters were not aware of the Sanitary and Phytosanitory (SPS) requirements of importing countries under WTO regime. Due to knowledge gaps, many exporters have learned the hard way implications of non-compliance to the SPS regimes in place in countries like Russia. During a meeting with Kinnow exporters in Sargodha, a leading exporter explained that poor understanding on part of many Pakistani exporters, especially the newer ones has hurt the industry in more than ways. Apart from financial losses, they bring poor name to the country and consequently there is a strong perception among the importers that Pakistan is a low quality/2nd grade exporter of citrus as compared to other suppliers. This contributes to the low price realization phenomena as well.

High loses during the post-harvest handling:

Several studies have highlighted the issue of high post harvest losses in Pakistan. For example, Johnson (2006, p. 2) had estimated that post-harvest losses of citrus fruits in Pakistan are estimated at 40 percent. Similarly, according to ACIAR (2008), 35 percent of the total produce of citrus in Pakistan is lost during pre and post harvest stages, and these losses are attributed to poor disease management practices, vagaries of weather, delays in harvest, poor harvesting practices, poor road conditions and cold storage facilities and oversupply of the product in some years. Another reason for high post-harvest losses of the Kinnow is its soft skin (Khan, u.).

During the validation process, the consultant learned that whereas the overall wastage as reported in the earlier studies has decreased, the overall loss of value is still substantial (20-25%) in many cases due to the quality of fruit (disease incidence, especially citrus greening and skin damages caused by insect pests). At the post harvest stage the major damage is caused by in appropriate transportation of fruit from orchard to processing facilities. Although many processors have started using plastic crates to lessen the damage to fruit during the transportation, bulk of the fruit is still transported in bulk on trolleys pulled by tractors. As per an estimate of processor 5-7% fruit gets damaged during the transportation. Due to skin damage, the same cannot be included in category A. Processors believe that due to low recovery of category A and B, their overheads and working capital needs also increase, increasing their cost of doing business. Although they have not calculated the extent of that, they feel their profitability is definitely hurt.

Inadequate Cold Chain Facilities:

A study by Mahmood & Sheikh (2006) reported that there were inadequate cold storage facilities in the Kinnow producing areas. The exporters and traders usually store the fruit in cold stores available in the vicinity of vegetable markets. Moreover, quality of cold storage facilities is very poor but their rents are high. Total storage facility for all fruits and vegetables in the country were reported around 0.7 million tons out of which only 0.07 million tons capacity were generally available to the citrus fruits during the peak period (Ali, 2004, p. 279).

During the validation exercise, it was found that whereas the overall situation has improved significantly since 2006-07 and more than 10 top exporters have their own cold storage facilities to meet their requirements. Further storage facilities are a must to coincide with efforts to increase yields of A and B grade.

Poor Transportation Facilities:

Kinnow Value Chain actors have been able to address the issue of shortage of refrigerated containers for exports with the collaboration of shipping companies operating out of the region. The issue of high rents still persists according to the exporters. The Value Chain players have also made arrangement to plug refrigerated containers to maintain cargo temperatures during the transportation from processing plants to Karachi port. Previously drivers of the refrigerated containers used to switch off the refrigeration to reduce the consumption of fuel (diesel), thus affecting the quality of fruit.

During the peak season of Kinnow crop production, gap between demand and supply of the refrigerated containers grows enormously, and shipping companies increase their rates, making refrigerated transportation very expensive for the exporters and a compromise on quality of services. The refrigerated containers are required to maintain a temperature of around $4^{o}C$, however, many a times refrigerated transport operators do not maintain required standards.

This also hurts exporters as quality of fruit is affected and result is spoiled fruit on arrival.

Relationships among the Value Chain Actors:

The existing relationships among the value chain actors may be characterized as “poor cooperation” caused by “mutual low trust”. This assessment found that there is a general mistrust among the value chain actors. Even growers tend to be more competitive rather than collaborative even if they do not have any clash of interests. Flow of information and sharing of experience is generally weak and superficial. One of the reasons that good practices do not propagate despite the fact that more progressive and resourceful has access to such information. The role of existing growers association “Pakistan Kinnow growers Association Sargodha” is insignificant as compared to growers association in other Citrus producing countries.

Similarly the exporters’ association is generally controlled by few top exporters of fresh fruits and vegetables. The association is managed by a club with limited access to information to members outside the club.

Limited flow of information and resulting coordination between producers, processors and exporters may be attributed to cultural reasons and some historical reasons as well, yet it is imperative for the competitiveness of the value chain. This consultant therefore is of the considered opinion that

unless the value chain actors interact on a platform to increase level of cooperation, the effectiveness of all efforts on a piece meal approach would not give desired results. Any intervention to provide ways and means for better dialogue among the stakeholders, enabling them to realize importance of collaboration among themselves and facilitating them to enhance level of trust between them could pave a way for better cooperation among them for mutual (collective interests).

Product Quality:

Pakistani Kinnow is regarded as B grade citrus for various reasons. Incidence of high number of seeds and skin blemishes are regarded as top reasons for the perception. Pakistani Kinnow exported to European markets are marked as 'B grade Citrus' to permit access to market. According to exporters, it is therefore difficult for them to negotiate better prices.

Pakistani exporters are generally targeting lower end of the market in all the markets it is exporting to. Therefore is unable to access higher paying markets due to low quality perception attached to its Kinnow. This is contrary to the general perception among the growers, processors as well as the policy makers who believe that Pakistani Kinnow is a premium product due to its unique aroma, flavor and taste attributes. The export data as well as the insights shared by leading exporters who frequently visit international trade fares and have market intelligence on their competitors confirm the trend that Pakistani Kinnow is being replaced by other easy peelers e.g. seedless Tangerines from China, seedless orange from China and seeded Mandarins also from China. Therefore Pakistani Kinnow usually gets low preference over its competing products and even when Mandarins are not available in certain time windows, the price offered to Pakistan product is very low (usually in the range of 50% Turkish or Moroccan Clementine)

Access to Markets:

Pakistan Kinnow is facing difficulties in accessing several markets. Russia, Iran and Indonesia have either banned imports from Pakistan or have imposed high tariffs in the past. Access to European markets is considered a barrier due to non-tariff or SPS related compliance requirements. Exporters want to diversify their markets. However they need support in understanding the market needs and establishing linkages as the entire process is resource intensive and time consuming.

Neither the individual exporters, nor the exporters' association or government support agencies are geared up for an integrated campaign in this regard.

It has been found during the interviews with the exporters and association that they feel that they need capacity to build new markets and are willing to undertake efforts. They however look towards TDAP or donor funded projects for support.

Quality of Citrus:

Several studies conducted in the past have identified that quality of Kinnow has been deteriorating over the years. During a survey conducted by Mahmood & Sheikh (2006) exporters expressed their opinion that quality of Kinnow had gradually deteriorated. The study concluded that diseases and insect pests were mainly responsible for it. Poor crop management practices (planting, pruning, fertilization, irrigation and spraying) had also contributed towards deterioration of quality and lower value in the international market (Mahmood & Sheikh, 2006).

During the validation process, the gravity or the extent of deterioration has fully come to fore. According to leading processors, they were able to recover only 30% “A” category product for the export shipments last year. This has come down from 60/70% a few years ago.

According to results of a comprehensive survey conducted by CABI exporters highlighted several issues related with quality of Pakistan Kinnow. First issue relates with skin of the fruit. They indicated that skin of Pakistani Kinnow is thick and blemished, while in the international market, citrus fruits with easily peal able that is free from any mark or spot is preferred. They also pointed out that shape of Pakistani Kinnow was not round in all cases, eventually; its acceptance in the international market is negatively affected. Third issue pertains to quality of fruit on arrival at destination ports, attributed to variation in the temperature in the cold storages, and containers.

Exporters pointed out that due to quality issues, per unit price earned by Pakistani Kinnow was low. They think improvement in cold storage facilities; improvement in picking practices and improvement in transport facilities can address many quality related issues.

Compliance Status:

There are serious issues/problems which hinder the exporters to maintain the quality standards. Pollution at orchards is effecting the production. Lack of knowledge, guidance and directional research of agriculture department is the primary problem. Short shelf life of fruit, introduction of seedless Kinnow in the international market and insufficient marketing by Government of Pakistan are the factors which are badly affecting the exports. Farmers need the support of government to properly manage their farms because fertilization application and pesticide spray are not at proper time with defined intervals and quantity. Processors demand subsidy on electricity and continuous provision of electricity to run the processing plants and maintain cool storage.

There is only one supplier of wax in Sargodha and processors have concerns over the quality of wax. It is largely known that the supplier of wax does not distribute imported wax and rather prepares the wax and sells it with international labels.

The quality control measures taken by the processors and exporters along the whole value chain primarily include, trained personal staff for picking, personal transport to bring Kinnow from farm to processing plant, separate packing room, immediate shifting to cool storage after packing, mixing of tacto powder (Antifungal) in water for washing and removing injured Kinnow during initial sorting

The requirements for additional quality improvement in the next three years are high. They include the provision of refer containers for the transport of Kinnow from Sargodha to Karachi, improvement in logistics with Provision of dedicated shipping lines, subsidy in freight, installation of sorting machine, use of mono vision technology, skilled labor for the maintenance of orchards, regular fertilizer and pesticide spray, skilled labor to work in processing plants, procurement of good quality processing Materials (Wax), improvement in cool storage, installation of small processing unit for B grade Kinnow to sell in local market and installation of conveyer system

Some of the processors and exporters have greatly improved their processing plants. They do not hesitate to bench mark the processes of picking, control Atmosphere (CA) store, timely Delivery, packing, and overall best processing practices

All the processors and exporters interviewed are engaged in compliance activities like achieving Certification to an International Standard, meeting Health, hygiene, and sanitary requirements, and complying Labor laws (child labor etc.).

Kinnow Exporters share that most of the importers, especially from the developed countries demand certification in HACCP [Hazard Analysis and Critical Control Points] from the exporters to ensure that a mechanism of systematic preventive approach to food and pharmaceutical safety is implemented by the suppliers, while addressing physical, chemical, and biological hazards. Similarly many importers require that their suppliers obtain produce from orchards that are GlobalGAP certified. Whereas there are only few dozen GlobalGAP certified farms in Pakistan as of September 2013, corresponding number for competing countries like China and Turkey run into hundreds.

A survey by UNIDO reveals that 75 percent of the surveyed exporters had certification either in HACCP or in GlobalGAP or in both indicating that quality consciousness among the Kinnow exporters in Pakistan had improved. It is however important that the base expands and more Kinnow orchards and processing players adopt good practices and traceability systems. This is imperative for enhancing value chain credibility in the eyes of its buyers.

Testing & Certification Capacity

To comply with the standards and the requirements of international markets it has become essential that Pakistani producers and exporters have ready access to the product testing laboratories.

Laboratories conducting testing should follow standard practices for sampling and testing and have controls in place, including equipment calibration, to ensure the accuracy of their results. The validity of test results ensured and accepted worldwide only if the laboratories possess internationally recognized accreditation to ISO 17025.

A recent study by UNIDO reveals that in Pakistan, there were 20 accredited testing laboratories (under TRTA), of which 6 laboratories cater for microbiology testing and 7 laboratories conduct chemical testing. According to the study, these accredited testing laboratories were enough to meet the demands of the country for product testing of agro based exports. Kinnow exporters however feel that internationally accredited laboratories should be near the main Kinnow citrus production clusters.

The standard tests demanded and conducted by the exporters of citrus cluster of Sargodha (Bhalwal) are Brix test (Sugar content), Residue test, Heavy metal test, Wax test, Pesticide test, Normal water biological test, Water test and test for nutritional composition. The exporters use the facilities of PCSIR laboratories, Lahore and NIAB, Faisalabad for these tests.

Currently, exporters have to send their samples to PCSIR laboratories, Lahore and NIAB, Faisalabad for testing. This consumes a lot of time. In a meeting with leading exporters, need for an internationally accredited laboratory at Sargodha was expressed.

Value Chain Support Organizations

Government organizations like PHDEC, SMEDA, PAMCO, TDAP, Investment Boards, Horticulture Research Institutes, Citrus Research Institute Sargodha, Agri-Extension Department, Agribusiness

Support Fund and donor agencies working for development of Horticulture sectors provide support to sector stakeholders.

According to one leading exporter there were 17 different entities working to facilitate or support horticulture sector and Kinnow as such. The exporter implied that in spite of many institutions working for the same cause, the end results were not improving for the value chain. It was a unanimous view in the validation workshop attended by representatives of various value chain stakeholders and representatives of support institutions that there was an apparent lack of effectiveness of efforts and money spend in this regards attributed to:

- Lack of coordination among the support institutions and donor funded projects, resulting in duplication of efforts in many cases and lack of efforts in other equally essential areas where efforts are needed to alleviate gaps/weaknesses in the chain;
- Quality of technical inputs,
- Effective management of projects/interventions;
- Lack of continuity,
- Lack of Joint ownership by value chain actors/stakeholders

Whereas there may be several possible solutions to improve the existing situation, in several countries specialized institutions have played an instrumental role in the development of citrus industry. For example, Citrus Board of South Australia (CBSA) has played an instrumental role in the development of citrus industry in Australia (CBSA, 2001). Similarly an institutional support system exists for citrus value chains in Spain, Turkey, Morocco and USA as well.

VII. Conclusions and Recommendations:

The analysis and synthesis below shows that

Situation

- Around 30% of orchard produce on average ended up in A Category for Exports last year (Situation is not different this year);
- Incidence of pest and disease is very high;
- Orchards are managed in traditional manner, growers are not keen to follow GAPs and remedial measure to curb effects of diseases;

Implication:

- The growers' profitability is decreasing
- Processors and exporters are feeling the heat of low profitability as their recovery of top grades is declining (from 70/75 to 30/35 last year), cost of operations increasing (Utilities increased by 50%, Cost of labor by 50/60% in last three years)

Constraints:

- Lack of knowledge/lack of motivation on the part of growers to adopt good agriculture practices
- Poor Harvesting and Product Handling (Contractor System)
- Limited interactions between the value chain actors (trust deficit)
- Institutional support is weak

- Limited role of Association (limited horizontal linkages)

Solutions

- Higher Yields are imperative
- Improvement is product quality is critical
- Higher level of trust among the growers and processors/exporters is a must for greater cooperation;
- Institutional support for arresting disease problem is critical (public and private both)
- Pakistan current export base is heavily dependent on Afghanistan and Russia. While the world market trends point towards expansion of demand, Pakistan exports, though expanding in volume, are not to high end markets (segments). The existing market system, does not provide any incentive to growers to work for improving product quality and it does not provide any incentive to processors/exporters to cooperate with growers, though their mutual cooperation is imperative for sustained growth of the both. Although there are growers associations as well as processors/exporters associations, there is no platform representing major actors across the Kinnow Value Chain . The value chain is losing its competitiveness due to several supply side constraints emanating from, low yields, product deterioration due to incidence of several diseases in the orchards.
- Incidence of diseases like Citrus Canker seems critical for the competitiveness of the chain;
- The value chain is also losing its competitiveness due to poor post harvest handing; harvesting irrespective of maturity index, skin damage during harvesting and transportation stages;
- Whereas awareness among the large growers and exporters is high, there is apparent lack of cooperation among the value chain actors to address issues with mutual cooperation;
- It is imperative to have “higher cooperation” among the stakeholders.

Sources, Detailed List of Interviews/Workshops

Annex A:
List of Sources, List of Interviews and List of Validation Workshop Attendees

a. Studies and Knowledge Sources:

1. Dr Amanullah Associate Professor University of Agriculture in Faisalabad, presentation on Agronomy related issues.
2. TRTA Study for SPS related aspects.
3. TAP VC Study for VC wide interventions
4. Kinnow Value Chain Knowledge gaps and ICT prevalence in the chain by CABI South Asia Survey 2008
5. TDAP Market Report on Kinnow by Naseer Ahemed
6. Australian Centre for International Agricultural Research (ACIAR) study on Citrus Sector under *Australia Pakistan Agriculture Sector Linkages Program.*
7. Ali, T. (2004). *Marketing of citrus fruit in Pakistan*. Dissertation for PhD in Business Administration, Department of Commerce, University of Karachi;
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10. Johnson, G. (2006, July). *Pakistan Citrus Industry Challenges: Opportunities for Australia-Pakistan collaboration in Research, Development & Extension*.
11. Citrus Industry http://www.aciar.gov.au/system/files/node/739/ASLP+citrus+scoping+study+report.pdf
12. Nursery performance of rootstocks of different citrus fruits under Sargodha climatic conditions. *Journal of Agricultural Research*, 2006, 44(2), 161-165. Nursery Performance.pdf;
13. PHDEB [Pakistan Horticulture Development & Export Board]. Citrus Marketing Strategy.
14. Sharif, M, Farooq, U. and Malik, W. (2005, Winter). Citrus Marketing in Punjab: Constraints and Potential for Improvement.
15. Sharif, M. (2004). *Opportunities and Constraints in the Production, Marketing and Export of Citrus in Punjab*. Ph.D. thesis, Department of Farm Management, Faculty of Agricultural Economics and Rural Sociology, University of Agriculture, Faisalabad.

b. List of People Interviewed:

SR#	Name	Designation & Organization
1	Shahid Sultan	MD, Shahid Sultan & Company Bhalwal
2	Ansar Iqbal	MD, Mateela Kinnow Factory, Bhalwal
3	Saadat Ejaz	Roshan Enterprise M.D
4	Dr. Waqar Ahmad	Horticulture Sector Advisor USAID FIRMS Project
5	M. Tahir Jamil	DDO/Agriculture Ext.
6	Dr. Basharat Ali Saleem	Agri Extension Horticulture, Sargodha
7	Muhammad Azhar Nawaz	Orchard Management Expert, University of Sargodha
8	Qasim Ejaz Qureshi	Kinnow Grower, Director Production Roshan Enterprises, Karachi
9	Waheed Ahmed	Iftikhar Ahmed & Company, Karachi (former President All Pakistan Fruit and Vegetable Exporters Association)
10	Aslam Pakhali	Chief Executive, F A International (Exporter)
11	Marcel Stallen	Fresh Dynamics Asia, CBI lead consultant for Kinnow value chain Assessment
12	Kuldeep Sharma	Suruchi Consultants. SAARC Consultant for Kinnow value chain Assessment
13	Muhammad Aureagzaib Khan	Sector Expert Horticulture & SPS Compliance UNIDO, Trade Related Technical Assistance Programme (TRTA II)
14	Kashif Jamshed	Chief Coordinator, Supply Chain Improvement Project, Government of Punjab
15	Muhammad Riaz	Manager Exports, Al Rafique Enterprises, Growers, Processors and Exporters of Kinnow, Sargodha
16	Dr Ijaz Ahmed	Consultant Horticulture and Food Sector, CBI, Netherlands
17	Zulfiqar Hayat	Director, Citropak Limited, Lahore
18	Zahid Munir Alvi	Chief Executive, Agro Processing Plant, Multan
19	Imtiaz Hussain	Managing Director, Imtiaz Enterprises; Exporters of Fruit, Karachi
20	Muhammad Naseer	Consul of Pakistan, Osaka, Japan
21	Asif Ali Shah	Country Business Manager, Pioneer Pakistan Seed Limited, Lahore
22	Laurent Nazet	GM Sourcing and Marketing, MAF Hyper Markets Pakistan
23	Shahid Hussain	Manager Merchandise, MAF Hyper Markets Pakistan
24	Mujeeb Rashid	Managing Director/CEO Mitchell's Fruit Farms Limited, Lahore
25	Mehdi Mohsin	Director, Mitchell's Fruit Farms Limited, Lahore
26	Asif Zia Khan	Regional Manager, Raaziq International, Logistics and Supply Chain Management
27	Khalil Ahmed	Manager Project, Ammizia Logistics and Warehousing, Lahore
28	Rashid Y Raja	Agricultural Marketing Specialist, US Department of Agriculture, Islamabad
29	Muhammad Javed Afzal	Manager Trainings, SMEDA, Lahore
30	Muhammad Faroque Memon	Director Trade Development Authority of Pakistan, Karachi
31	Muhammad Ashraf	Deputy Secretary, Ministry of Commerce, Islamabad
32	Nasreen Ali	Director General, Board of Investment, Karachi
33	Nauman Aslam	Pakistan Commercial Counsellor, Beunos Aires, Argentina
34	Dr Saeed Qadir	Pakistan Commercial Counsellor, Dubai, UAE

Note: Contact coordinates of participants are available with the consultant.

c. List of Kinnow Attendees Validation Workshop

Attendance Sheet
Validation Workshop with Stakeholders of Citrus Value Chain
October 02, 2013, Hotel Park Plaza Lahore

SR#	NAME	DESIGNATION & ORGANIZATION
1	Asad Zahoor	JAA consultant
2	Omar Cheema	Farmer Associates of Pakistan (FAP)
3	Zulfiqar Hayat	Citro Pak Ltd. Director
4	Saadat Ejaz	Roshan Enterprise M.D
5	Dawood Qasim	Roshan Enterprise
6	Dr. Waqar Ahmad	Kinnow Expert
7	M. Tahir Jamil	DDO/Agriculture Ext.
8	Dr. Basharat Ali Saleem	Agri Extension Horticulture
9	Muhammad Azher	University of Sargodha Lecturer
10	Aeyesha Gulzar	ASF - TAP
11	Derald Smart	JAA - TAP
12	Zeeshan Tahir Bhatti	SGS Pak Pvt. Ltd Executive Officer

Note: Contact coordinates of participants are available with the consultant.

Attendance Sheet

Validation Workshop with Stakeholders of Citrus Value Chain

Mateela Kinnow Factory, Bhalwal, Sargodha

Sr#	Name	Designation & Organization
1	Shahid Sultan	MD Shahid Sultan & Company, Kinnow Exporters
2	Haji Muhammad Azam	Kinnow Grower, Convener Kinnow Cooperative
3	Ansar Iqbal	Mateela Kinnow Factory
4	Chaudhry Amjad	National Kinnow Exports
5	Abdul Rehman	Pathologist, Agriculture Extension Department, Sargodha
6	M. Tahir Jamil	DDO/Agriculture Ext.
7	Dr. Basharat Ali Saleem	Agri Extension Horticulture
8	Suhail Aftab	Kinnow Nursery
9	Derald Smart	Component Leader IMLP, J E Austin Associates, TAP
10	Mathew Brown	International Market Linkages Expert, J E Austin Associates
11	Dr Hamid Jalil	Agribusiness Specialist, J E Austin Associates, TAP
12	Asad Zahoor	Value Chain Consultant, J E Austin Associates
13	Dr Ehsan Qazi	Value Chain Specialist, J E Austin Associates

Note: Contact coordinates of participants are available with the consultant.

Annex B: The Clementine Mandarin Industries of Morocco and Spain

The study trip report is included to provide insights into two leading Citrus exporting Countries (competing value chains).

The Clementine Mandarin Industries of Morocco and Spain: Highlights of the Study Trip Sponsored by the California Citrus Research Board.

By: Guy W. Witney, *Production Research Manager, California Avocado Commission*
C. Thomas Chao, *Department of Botany and Plant Sciences, University of California, Riverside*

Introduction

In recent years, increasing interest in Clementine mandarins (tangerines) in the global market has led to new plantings in California. Most of these new plantings are still young, and many growers lack good information and practical experience in Clementine management. Last year, a Mandarin Task Force was formed by the California Citrus Research Board (CRB) to address the concerns of California mandarin growers. One of the action plans of the task force was to send us to the Clementine mandarin production regions of Morocco and Spain. The purpose of this study trip was to make contact with key researchers, organizations, and growers of Clementines and to transfer key information on the management of Clementine mandarins to California growers. This report summarizes our find-ings from the first short study tour.

The Moroccan Industry:

Our trip began on April 2, 2000, in the coastal city of Agadir, Morocco. The region is largely a tourist destination for British and French visitors who enjoy the great expanses of desert, clean beaches, and ancient culture. However, Agadir is also on the edge of the Souss Valley, which is the largest Clementine mandarin production area of Morocco. The climate of the Souss Valley is not unlike that of the southern San Joaquin Valley, with similar annual rainfall, slightly warmer average summer temperatures, and perhaps slightly cooler nights. Our host in Morocco was Dr. Mohamed El-Otmani, a Professor in the Department of Horticulture at the Hassan II Institute of Agronomy and Veterinary Sciences. Dr. El-Otmani, a former student of Dr. Charlie Coggins at UCR, was a superb host and made our trip both productive and enjoyable.

Current status of the industry

The history of citriculture in Morocco dates back to Roman times, but today the industry is as modern as any in the world. The total citrus acreage is 213,284 acres with 72% oranges (mainly navels), 26% mandarins (Clementine and Satsumas), 1.1% lemons and limes, and 0.35% grapefruit and pummelos. While the Moroccan citrus industry produces only 0.89% of world citrus tonnage, it is the fourth largest fresh citrus exporting country and second largest fresh mandarin exporting country in the world (USDA statistics, 2000). European Union (EU) markets account for most of Morocco's citrus exports. Morocco's top-quality citrus are exported to the EU, and its second-quality fruit are exported to Eastern Europe and Russia. (P.L. Arribas, 2000. CLAM 99/2000: previsión de exportación. Todo Citrus V.8: 60 - 61.). Citrus farms are relatively large in Morocco (larger than those in Spain) with each unit averaging more than 200 acres. The cost of labor in Morocco is very cheap compared to both Spain and the U.S. Inexpensive labor is per-haps the biggest advantage the industry has over those in other countries.

Citrus-growing regions and climate in Morocco

There are three major citrus production areas in Morocco (ranked by production volume): the Souss Valley, the Central area, and the Oriental region. Citrus production areas are localized due to climate,

topography, and water avail-ability. The Central area is humid, has some of the oldest citrus groves, and used to be the largest citrus-producing area in Morocco. In recent years, however, the Souss Valley has surpassed the Central area in production. The Souss Valley is the southernmost citrus production area of Morocco; it has an arid climate with hot summers and very dry weather. This region now produces about half of all citrus and half of all mandarins in Morocco. The Oriental area is located in the northeast corner of Morocco near the Mediterranean Sea and has a somewhat arid climate and salty soil. Both the Souss Valley and Oriental area are suitable for early Clementine mandarin production.

Common citrus varieties grown in Morocco

The varietal trends in new Clementine plantings (in order of importance) are 'Nour', 'Larache', 'Nules', and 'Sidi Aissa'. Other varieties grown include 'Berkria', 'Bruno', 'Marisol', 'Codoux', 'Oroval', 'Esbal', 'Muska', and 'Guerdant'. Mandarin hybrids including 'Ortanique' and 'Nova' are also produced.

Rootstocks and nurseries

Ninety-eight percent of all citrus rootstocks in Morocco are sour orange. We were told that there is no citrus tristeza virus (CTV) in Morocco, although it could potentially reach Morocco. Scientists outside of Morocco, however, have advised us that CTV may already be present in some areas. Aggressive growers are testing other citrus root-stocks. We observed several 3- to 4-year-old plantings of 'Nules' and 'Nour' on Carrizo (*C. sinensis* [L.] Osbeck x *P. trifoliata* [L.] Raf.).

Management of Clementine mandarin production in Morocco

- **Planting density.** Most Clementine mandarins in Morocco are planted at 20' x 13' (167 trees per acre), although we saw orchards with higher planting densities (20' x 10' and 10' x 10'). We also saw considerable top working of 'Nour' onto Valencia orange. Growers in Morocco have found that the mandarins produce larger fruit and that the trees fill the orchard quickly when topworked onto Valencia orange. The topworking of Valencia orange may be a possible practice for California growers and further investigation is needed.
- **Pruning and alternate-bearing management.** Fruit is thinned manually in some orchards, but this practice depends on the variety, fruit load, and tree vigor. The cost of fruit thinning is $0.20 U.S. per tree and is usually done in June or July after fruit drop when fruit are 18 - 20 mm (approximately 0.75 inch) in length.
- Clementine mandarins are pruned annually to increase fruit set and fruit size. All pruning is done manually since labor is inexpensive. Pruning is usually performed after harvest in December to March depending on the maturation and harvest time of each variety. Pruning may be initiated when trees are in their second year, but growers generally want to encourage growth for production and begin pruning in the fourth year, especially in 'Nules' blocks. Trees are rarely topped. For 'Nules', interior pruning allows light into the canopy (vase). There is very little interior prun-ing for 'Nour', however; most pruning is exterior, around the canopy, because 'Nour' is a much more vigorous vari-ety than 'Nules'. 'Nules' and 'Marisol' require more pruning than 'Nova'. We were told that the cost of pruning these trees is around $0.40 U.S per tree.
- Moroccan growers find that the later the harvest, the greater the intensity of alternate bearing. Pruning is the primary tool to combat this trait. Generally, limited pruning is performed after an "on" year, while more severe pruning is done after an "off' year.

Citrus seedling production at M. Kabbage's nursery near Sebt-Guerdane, Morocco

In the past, girdling was performed to mitigate alternate bearing; however, girdling may have long-term adverse effects on Clementine trees. The application of plant growth regulators (PGRs), especially gibberellin (GA_3), is the most important technique to manage the alternate-bearing pattern of Clementine mandarins. After an "on" year, 10 to 15 ppm of GA_3 is applied once at 50% to 100% petal fall if trees flower within a 1 to 2 week period. The flowering period spreads over 3 or 4 weeks, then two applications of 10 ppm GA_3 are needed. PGRs are usually applied in early morning to avoid heat. After an "off" year, GA_3 applications may not be necessary. One application of GA_3 is usually applied to ensure proper fruit set. One reason for this application is to prevent excessive fruit drop due to hot winds during the spring and early summer.

Seediness. 'Fortuna', 'Ortanique', 'Temple', 'Nova' and 'Wilkins' produce pollen with high germination rates, resulting in the production of seeds in other Clementine varieties. 'Wilkins' has been removed from all areas in Morocco as required by law since it was especially problematic. 'Ortanique' is now on the list for tree removal. We observed that 'Star Ruby' grapefruit, Valencia orange, and navel orange planted with Clementine mandarin did not cause the resulting mandarins to have seeds.

Irrigation. Due to a lack of water resources in the country, many growers have switched from furrow to drip irrigation in recent years. The salinity level of irrigation water is between 0.7 - 1.4 EC. Because sour orange rootstocks, which dominate the industry, are sensitive to salts, it is common to irrigate during a rain in order to prevent the movement of salts into the root zone. Water shortages are a major problem for Morocco's agricultural regions, especially in the Souss Valley.

Nutrition. Leaf analysis is used to guide the application of nutrients to the trees. The nutrient levels of citrus leaf tissues in Morocco are generally maintained at lower levels than the published norms in California. The nitrogen norm for Clementine is 1.8% - 2.2%. Growers generally apply 800 - 1000 g (1.75 - 2.2 lb.) of nitrogen per tree per year in irrigation water. Zinc and iron are applied as sequestrene foliar sprays. The soil in Morocco is often calcareous, with a high pH and poor organic matter content.

Disease and pest management: There are four major pest problems in Morocco: (1) California scale, (2) red mite, (3) leaf miner of a different species than in the U.S., and (4) fruit fly. Thrips are a minor problem and so are aphids. All pests are controlled with chemical sprays; however, biological control work on leaf miner has been initiated with funding from FAO. Researchers are promoting integrated pest management (IPM) practices, but no insectaries have been established in Morocco. Common diseases in Morocco include Psorosis and *Phytophthora* gummosis.

Future development of the Moroccan citrus industry

The Moroccan mandarin industry continues to grow and has potential. The industry's biggest advantage in the world market is cheap labor, while the availability of water is the greatest limitation to its growth. Recently, tomato mosaic virus has greatly reduced the acreage of Morocco's winter tomato industry (a major European supplier), and some of this acreage may be planted with Clementine. The citrus industry

is expanding into either early- or late-season Clementine mandarins. Diversifying their export markets and specifically targeting the U.S. markets are two goals of the industry.

THE SPANISH CITRUS INDUSTRY:

We concentrated our research in Spain in the Clementine-growing region around the Valencia province, a spectacular region with the ancient city of Valencia in the center and many small farming operations spreading north and south on the Mediterranean coast and inland. The region has a traditional Mediterranean climate with an average 13 inches of precipitation falling mostly in the winter months. Valencia is a traditional Clementine-growing area with farming operations and orchards dating back several generations. As a result, most farms are very small, as land was divided again and again among descendents until parcels were no larger than one or two acres each. Most land is owned by absentee farmers who perform the necessary work on weekends or with local help. Trees are kept small and almost all labor is performed by hand. Although there are some large operations in the Valencia area, most large operations are in southern Spain, an area that has seen rapid expansion in citrus acreage in recent years.

'Ortanique' tangor sold at local souch (market) in Agadir, Morocco.

Current status of the industry

Spain is the world's largest fresh citrus exporter despite being fourth in total production behind Brazil, the U.S., and China. Almost 70% of their production is exported to Europe with most going to Germany, France, the United Kingdom, and the Netherlands. In the 1999 - 2000 seasons, a severe oversupply of mandarins in export markets caused the price to fall below profitable thresholds for growers. During our visit it was apparent that many blocks (particularly midseason varieties) were not harvested due to low prices resulting from oversupply. In 1999, approximately 284,000 ha (701,000 acres) of citrus were harvested (FAO statistics).

Citrus-growing region and climate in Spain

The major citrus-growing area in Spain is the Levante (Valencia) area (north and south of the city of Valencia). Farm size in this area is small and averages 1.24 acres. The other large growing area is the Andalusian with two distinct zones: the coastal region and the Guadalquivir River Valley. The Guadalquivir River Valley region is in southern Spain and is a rapidly growing citrus region with farming operations that are on average larger than 250 acres.

Common citrus varieties grown in Spain

About 40% of new citrus plantings in Spain are mandarin varieties. Half of these are 'Clemenules', but plantings include significant acreage of 'Marisol', 'Hernandina', and 'Ortanique'. 'Okitsu', 'Nova', and 'Fortune' were widely planted in the past.

Based on 1994 - 1995 production data of Clementine mandarin in Spain, 'Nules' accounted for 63% of total Clementine production, followed by 18% 'Oroval', 8% 'Hernandina', 6% 'Fina', and 5% early Clementine varieties such as 'Marisol', 'Oronules', 'Arrufatina', and 'Esbal'.

'Nules' has been widely planted because it is reliable in fruit set and production. This variety has been planted in different growing regions, both north and south, with good results. (Such results were contrary to those in Morocco, where varietal yield and fruit quality were reported to be very region specific.) 'Nules' can produce up to 40 tons/hectare (approximately 16 tons/acre) in southern Spain.

'Marisol' is an early Clementine, but the rind tends to puff if it rains or if harvest is delayed until colorbreak. As a result, fruits are picked early and degreened. 'Marisol' produces approximately 35 - 40 tons/hectare (14 - 16 tons/acre).

Our impression was that 'Lorentina', a new early variety, was considered an important recent development in the Spanish industry. This variety has superior flavor, size, and yield and should be pursued by the California industry. 'Lorentina' is a patented variety resulting from a mutation of 'Marisol' and was originally found at Tormos in Ali-cante Province in 1992. 'Lorentina' ripens earlier than 'Marisol' (the earliest Spanish Clementine on the market so far), and it has better organoleptic and commercial fruit characters.

Rootstocks and Nurseries

CTV was first found in Spain in 1957. Before the CTV outbreak, there were more than 2000 citrus nurseries. Since 1968, certification of citrus seedlings has been mandatory. Currently, more than 70% of all citrus trees in Spain are certified as disease free, and the rest (near 30%) are older trees that are still on sour orange rootstocks. The root-stocks used by the Spanish industry include: Carrizo Citrange, C-32 Citrange, C-35 Citrange, Citrumelo CPB 4475, Navel Amargo (*C. aurantium*), *C. macrophylla*, *C. volkameriana*, Gou Tou, Cleopatra mandarin, *Poncirus trifoliata,* and *Poncirus trifoliata* Var. Monstrosa Swingle.

For new plantings or replanting, 80% of rootstocks are Carrizo, 5% are *C. macrophylla*, (which perform better on calcareous soil and are salinity tolerant), 5% are Cleopatra (which produce smaller fruits and lower yield than the other rootstocks in Clementine), and 4% are *C. volkameriana*. In the Murcia Province near Valencia, 60% of new plantings are on *C. macrophylla* rootstocks due to the warmer climate and calcareous soil. The nursery industry in Spain supplies approximately 10 million trees a year, 50 - 60% of which are for replanting. However, due to the low return for fruit in 1999 - 2000, it is estimated that only 3 - 4 million trees will be planted in 2001, and the nursery industry will be severely impacted.

Management of Clementine mandarin production in Spain

Planting density. In general, mandarin plantings in Spain were closely spaced, with common densities of 20' x 10' and 20' x 6.5'.

Fruit set and fruit size. The major production areas of Spain do not generally experience low fruit set, however as a precaution, growers will apply GA_3 to ensure good fruit set. Fruit is not commonly thinned manually because of the high labor cost. To increase fruit set, one 5-ppm application of GA_3 is applied at petal fall if flowering lasts from 7 to 10 days. If flowering is prolonged, then 2 or 3 applications of GA_3 at 2 - 5 ppm are used. The application of GA_3 is used in conjunction with girdling or ringing (<1mm) to

increase fruit set; if flowering is prolonged then the efficacy is marginal. Ringing is done from around 15 days before anthesis up to 20 days after petal fall to reduce fruit drop. The practice is not usually performed on trees less than 5 - 6 years old and is done on secondary branches off the main scaffold branches. Research in Spain suggests that GA_3 will not reduce June fruit drop because this drop results from a carbohydrate imbalance and is not due to a lack of GA_3. On the other hand, fruit drop at petal fall is probably due to a hormonal imbalance, so GA_3 is effective.

Growers have observed that GA_3 works better on the northeast side of the tree because that side is cooler. It follows that the southwest sides of trees need more GA_3. 'Nules', 'Lorentina', 'Oronules', and 'Fina' specifically require GA_3 applications to ensure good fruit set. 'Nules' usually flowers for a long period of time. The mid-bloom period (10 - 15 days after the first bloom) produces the highest quality fruit. Applications of 2.5 ppm GA_3 to the first bloom and to the mid-bloom are used to increase fruit set. No GA_3 is applied to the late bloom because it produces fruits with the lowest quality. Results from GA_3 are erratic on 'Hernandina' and 'Oroval', and GA_3 does not work for 'Ellendale' and 'Fortune'. 'Esbal', 'Marisol', 'Nova', 'Ortanique', and 'Okitusu' readily set fruit and do not need GA_3 applications. An additional use of GA_3 is at color break. Applications of 5 ppm GA_3 to fruit before color-break can hold the fruit for an additional 3 to 5 weeks, but these fruit will have a lower juice percentage.

To increase fruit size, Spanish growers use synthetic auxins—particularly 2,4-dichlorophenopropionic acid (2,4-DP). These applications can increase fruit size by 5% - 10%; however, they are not applied to young trees because the application can result in coarse-textured fruits. One application of 40 - 100 ppm 2,4-DP is applied to some varieties to improve fruit size when the fruits are 0.6 - 0.8 inches in length (after June drop). This application increases fruit diameter by about 0.25" and has no thinning effect.

An application of 10 - 15 ppm of 3,5,6-trichloro-2-pyridyloxyacetic acid (3,5,6-TPA) can also improve fruit size more efficiently than 2,4-DP. However, this material can also have a fruit thinning effect. Such an application is usually performed about 110 days after flowering.

Pruning and alternate bearing management; The pruning of citrus in Spain is done manually and the cost of pruning represents about 20% of all cultural costs for citrus production. Pruning can slightly increase the fruit size of Clementine mandarins. It is usually performed starting 2 - 3 years after planting and occurs in the spring and summer. The resulting shape has 2 - 3 main scaffold branches dominating the tree in a semi-open vase.

The older branches of Clementine produce lower-quality fruits and so are routinely pruned. Most Clementine mandarins throughout Spain are pruned using the same method. Trees are usually around 8 to 10 feet tall even if they are 30 to 40 years old. Thus, pickers do not need ladders to harvest, but simply step on plastic harvest boxes to reach fruit in the highest part of the canopy.

Several growers told us that in contrast to Morocco, Spain does not have a major alternate-bearing problem with Clementines. Navel and Valencia exhibit some alternate-bearing tendencies, and growers apply GA_3 in the winter before an 'on' year to reduce the next year's flowering. Some growers indicated that Clementine mandarins could have a slight alternate-bearing tendency if harvest is delayed.

Seediness. 'Ortanique' and 'Fortune' can produce seeds in other Clementine mandarins. If there are no bees, the minimum safe distance from a pollen source to ensure seedless Clementine production is 164

feet. Recent legislation in the Valencia province requires that bees are kept approximately 3 miles from any Clementine orchards and local governments pay beekeepers to relocate hives.

Irrigation. Flood irrigation is the most frequently used method. The use of drip irrigation is increasing, particularly in the south, where almost 100% of all new plantings use drip irrigation.

Future development of the Spanish citrus industry

Based on the past ten years' growth, the Spanish citrus industry will most likely continue to expand, especially in the southern Guadalquivir River Valley area. However, the low financial return of the 1999 - 2000 season will slow the growth of the industry in the near future. Researchers, nurseries and growers will continue evaluating and develop-ing either early or late Clementine mandarin selections other than 'Nules' to expand the market window.

Figure Legends.
Citrus seedling production at M. Kabbage's nursery near Sebt-Guerdane, Morocco;
'Ortanique' tangor sold at local souck (market) in Agadir, Morocco.

Annex C: A Profile of Indonesia Citrus Market

Indonesia, the fourth largest market in the world with a population of 220 million in 2005, is forecast to reach 250 million people by 2015, making it a large food market. Consumption of fresh food is increasing and citrus consumption has been increasing at a faster rate compared to other horticultural products. City consumers are becoming more health conscious and this has opened up opportunities for the modern retail sector to expand further into fresh foods.

Indonesia has over 17,000 islands and this provides a major challenge to distribute fresh products nationally. Most of Indonesia's locally produced fresh fruit is distributed throughout Indonesia in non refrigerated trucks. Whereas, imported fresh fruit is sent by refrigerated containers to the various provinces.

The traditional wet markets still dominate fresh food trade however there is a trend to shopping at modern outlets particularly for fresh fruits due to better displays and better access to imported fresh fruits. Most supermarkets and hypermarkets in Indonesia have expanded their share of the retail market with the opening of new stores throughout major cities in Indonesia and with an increased emphasis on fresh food. Retailers say they expect 17% growth in 2007 while hypermarkets and mini-markets will grow by 25%. While the majority of the modern supermarkets and hypermarkets are located in Jakarta, there are now a number of modern retailers located in provinces in East Indonesia (particularly in South Sulawesi).

Citrus sales are an important part of modern retailer's fresh fruit section. Retailers have a wide range of local and imported citrus for sale with specials most weeks. Larger ("jumbo") citrus varieties are popular and can command higher selling prices.

While fruit imports have been increasing at more than 20% per year, citrus imports comprise only 3.6% of Indonesia's citrus consumption and 22% of all imported fruits with 53,659 tons of mandarins and 29,712 tons of oranges in 2005. China was the major supplier of mandarins and orange imports with 72% and 38% respectively.

Over the last six years, citrus production in Indonesia has increased by about 400% to reach 2.2 million tons in 2005. Citrus represented about 10% of fruit production in 2005. Five provinces dominate citrus production - North Sumatra, East Java, South Sumatra, South Sulawesi and West Kalimantan – accounting for 70% of Indonesia's production.

Table: Sales of Citrus at Sogo Supermarket, December 2006

Local Citrus	**Sales Qty (Kg)**	**Price (Kg)**
Mandarin Medan Jumbo	2,124	19,880
Orange Bali Aceh	1,911	22,110
Mandarin Pontianak/Siam	788	13,910
Orange Baby Pacitan	647	12,650
Orange Baby Java	62	13,270
Mandarin Medan Super	47	15,270
Orange Bali Besar	19	16,550
Total	**5,599**	**18,840**

Import	Sales Qty (Kg)	Price (Kg)
Navel Orange Jumbo RRC	3172	21,740
Mandarin Shantang Daun	1972	24,280
Navel Orange USA	1221	27,500
Mandarin Ponkam	1163	19,810

Navel Orange Australia	839	26,310
Mandarin Thanathon Thailand	786	25,380
Orange Baby Egyft	580	20,970
Mandarin Lokam	528	15,010
Mandarin Grape Fruit Aust.	422	27,820
Mandarin Kinno	366	19,250
Total	**11,049**	**23,020**

There has been a gradual increase in modern retailers opening stores in regional Indonesia to meet the increased consumer purchase power in some of the provinces. About half of the 33 provinces of Indonesia have witnessed investment by the modern retailer. While the majority of the modern supermarkets and hypermarkets are located in Jakarta, there are now a number of modern retailers located in provinces in East Indonesia (Table 4).

Citrus Production

Indonesia's annual fruit production has been increasing over the last five years to reach almost 12 million tons. The main fruits grown in Indonesia are bananas and mangoes; accounting for 50% of the horticultural production. Citrus accounted for about 10% of fruit production in 2005.

Over the last six years, citrus production in Indonesia has increased by about 400% to reach 2.2 million tons in 2005, from about 70,000 hectares. During this period the productivity increased from 19 tons to 33 tons per hectare.

While most of Indonesia's 33 provinces grow citrus, five provinces dominate production as follows: North Sumatra (586,578 tons), East Java (395,428 tons), South Sumatra (218,397 tons), South Sulawesi (157,783 tons) and West Kalimantan (146,314 tons); these provinces account for 70% of Indonesia's production. (Figure 1)

The largest growth in citrus production over the last 6 years is West Kalimantan (Pontianak) which expanded by a massive 8,000%. The other major citrus producing regions of North Sumatra (Medan), East Java (Malang) and South Sumatra all expanded their production by about 500%, 900% and 5,000% respectively, whereas South Sulawesi expanded its production by only 100%.

In 2005, Indonesia exported US$10.7 million (16,800 tons) of fresh fruits; most of this was mangosteen. Only 600 tons of citrus was exported in 2005, down from 1,000 tons in 2004.

Citrus Imports

Indonesian fruit imports have increased by an average annual growth rate of 22% (in volume) over the last

China continues to dominate fresh fruit imports with the majority share across all major imported fruits, except grapes. China has the major share of mandarins and orange imports with 72% and 38% respectively. (Figure 3) Citrus imports comprised only 3.6% of Indonesia's citrus consumption in 2005, down from 7.5% in 1999.

Conclusions and recommendations

Market Demand for citrus is strong.

Indonesia is a large and growing market and with a population to reach 250 million people by 2015 offers many opportunities for food suppliers from Eastern Indonesia. With Eastern Indonesia having only 10% of the population then it needs to establish linkages with provinces in the western part of Indonesia to sell its products.

As the economy continues to grow (forecast to expand by 6.3% GDP growth in 2007) then there will be more investment in the resource rich provinces of Eastern Indonesia. This will lead to improvements in the cold chain and retail sector and provide further opportunities for citrus suppliers. The consumption of fruit is an important part of the Indonesian diet and citrus has a rapidly increasing share of the consumer expenditure budget.

Imported Citrus Supply has only a minor share

Citrus imports have increased by an average of only 7.5% per annum to reach 83,000 tons in 2005 and represent about 22% of all fruit imports. Imported fruits are only a minor part of the total fruit consumption in Indonesia with imported citrus accounting for only 3.5% of citrus consumption. The modern retail sector is an important outlet for imported fruits and the cold chain is used for imported fruits but not for local fruits.

Traders control the East Indonesian Citrus Marketing Channels

Most of the citrus growers are price takers and rely on local or city based traders to sell their produce. There is minimal market price data that is provided to growers and growers get paid a price depending on their relationship with the trader. Larger size fruit can earn the farmer twice as much income as smaller sized fruit.

There is no cold chain being used for local citrus and this can result in high wastage compared to imported citrus and reduced returns to farmers. Better access to post harvest facilities may reduce

Annex D: Detailed Analysis of Constraints Affecting Kinnow value Chain Competitive Position

A detailed study by Australian Centre for International Agricultural Research (ACIAR) had listed constraints faced by Kinnow production in Pakistan.

15. Unreliable supply of certified seeds and bud wood;
16. Inefficient fruit production and irrigation practices;
17. Inadequate pest and disease management strategies (Gummosis and canker disease);
18. Lack of cultivars and rootstocks;
19. Lack of coordination between Research, Education, Extension and Farmers;
20. Dysfunctional research and extension system;
21. Small scale farming;
22. Pre harvest contract system (advance sale to middle men);
23. Disadvantaged growers with lack of knowledge, and Literacy and access to information.

Growers confirm that the present situation is not different from the one prevailing in 2010. They maintained that Citrus production is considered a risky venture as its success largely depends upon several exogenous factors like weather, market situation etc. They were of the opinion that risk had actually increased for the growers as well as contractors/processors in the wake of ban imposed by the largest importer of Pakistani Kinnow through sea, this year. Also they perceive high risk for Afghanistan market due to anticipated return of NATO forces from Afghanistan in 2014.

At the production stage, following situation prevails:

Low Yields:

Yield of citrus in Pakistan is quite low as compared to that in Brazil, USA, and China. According to FAO Statistics of 2011, average national yield of citrus in Pakistan is around 90,760 hectogram per hectare, while per hectare yield of citrus is 151,652 hectogram in China, 129,950 hectogram in Turkey and 285,714 in USA.

Whereas well managed orchards are reported to produce between 18-20 tons per acre, average orchards yield between 10-12 tons per acre. Orchards not properly managed usually yield between 6-8 tons in an "on" year. The average reported yield per acre is quite low as compared to top producing countries, despite the fact that Kinnow mandarin is regarded as a heavy fruit bearer as compared to other citrus varieties. According to Crop Reporting Services (Agricultural statistics of Pakistan) data, Citrus yield per hectare was 11.57 tons per hectare or 4.62 tons per Acre. . The reported yield in Pakistan is lower than other leading producers.

Production/yield fluctuates substantially due to alternate bearing phenomena in Kinnow production areas attributed to several reasons including lack of canopy management (lack of pruning practices) and poor plant nutrition management.

Quality of Produce:

Quality of the crop is low compared to international standards. It is estimated that about 45-50% of the harvest is of a quality acceptable on world markets while another 20-25% though unsuitable for export, is of a quality acceptable to the top quality range of the domestic market. According to

leading Kinnow processors cum exporters, if an overall up to 50% harvested produce can be selected for top segments of export and domestic markets; a viable proposition does exist for the processors. Anything below 50% would render the commercial operation unviable.
Leading processors and exporters also maintain that there is an urgent need for better management practices at orchards to improve ratio of A & B grades from the overall quantities produced. According to them comparable international ratio is above 90%. A significant focus is required at the production level to keep the Pakistani Kinnows cost competitive in the export markets.

According to Dr Waqar Ahmed, an expert on good agricultural practices, irrigation is one of the most crucial agronomic inputs that play a vital role in crop improvement. According to him, at present Citrus growers do not manage the orchards on scientific lines for water management and apply canal water or tube well water. The quantum of irrigation water applied is not based on crop requirements and does not correlate with the phenology of the crop and climate, but it is on the adapted cultural practices in the citrus growing belt. He states that it is a very well determined fact that citrus thrives better under low but frequent irrigations than over-irrigation (Horticulture Industry, University of California, Barkley). Growth sensitive periods to water shortage are flowering time (Feb/Mar), fruit setting and rapid cell multiplication (Apr/May). Again during cell elasticity stage (Sept/Oct) frequent irrigation is required to compensate the water deficit in the plant body during these critical stages of plant flush growth and fruit development and enlargement in befitting manners.

Secondly the farmers commonly practice inter-cropping mostly with fodder and wheat in the orchards for their food and feed security. In most of the cases flood irrigation is done in the whole field. Some farmers put basin round each tree with channels connecting basins so that irrigation of fruits trees can be independent of the intercropped area between the tree lines which have different water requirements. However, all these methods are non scientific and result in a lot of wastage of water and also results in poor crop growth and ultimately yield.

There is an urgent need to develop irrigation method based on evapo-transpiration (ETo) of the crop for various stages of fruit development and water use efficiency of the crop. Orchard floor management for the better utility of water with reference to soil texture has never been tried to suggest the application of irrigation in citrus. Deep ploughing and heavy irrigation alternatively to conserve the soil moisture "wattar" is a common practice in the area. This practice is deleterious for the plants as it cut the soft fibrous roots of the plant, thus leading to less absorption area for the next irrigation; also it causes the root infection leading to Citrus Sudden Death-CSD, now more common in young orchards. Similarly, addition of organic matter and use of organic or artificial mulching is not practiced for the citrus to increase the water holding capacity of the soil.

At the present, only few orchards use precision irrigation systems like drip irrigation and micro sprinklers under the tree canopy. High density plantation coupled with HEIS is an alternative approach to save the water and enhance the fruit quality.

Non Availability of High Yielding Kinnow Varieties:
Non-availability of high yielding Kinnow varieties is considered as one of the root causes for low productivity/yield followed by poor orchard management practices. It is a well considered opinion among the experts interviewed that yield can be significantly improved by introducing new varieties with higher yield potentials. Growers are of the opinion that availability of disease free plants of a

high yielding Kinnow variety is imperative for the future survival of the value chain as the yield as well as quality of harvest has declined substantially over the years. For instance according to FAO statistics per acre yield of Pakistani Kinnow is approximately 5 MT per Acre as compared to 11.5 MT in Florida, which has similar climatic conditions for the growth. Similarly the ratio of "A and B" category has dropped to 30-35% of total harvest from 60-70% for most of the orchards in Sargodha and Bhalwal areas whereas the international bench mark (Morocco and Turkey is 90% of total harvest).

Increasing Cost of Inputs:

The CABI International survey reported a substantial increase in global fertilizer prices. For example, average international market price (FOB) of urea (black sea) increased from mere US$ 79.3 per metric ton in 1999-2000 to US$ 255.8 per metric ton in 2006-07. During the corresponding period, average market price of DAP rose from US$ 153.5 per metric ton to US$ 320.8 per metric ton.

In the domestic market, the prices also rose following the same trends. For example, price of urea increased from Rs. 324 per bag of 50 kg in 1999-2000 to Rs. 1800 in 2012-13. Similarly, price of DAP surged from Rs. 632 per bag to Rs. 3500 during the afore-said period.

Similarly a sharp increase in the prices of other inputs has been experienced by Kinnow growers in Pakistan. There has been a 60% increase in cost of utilities over the last five years and similarly cost of fuel has witnessed over 100% increase in the last five years. These inputs are essential for Kinnow growers as they have to pump irrigation water using either electricity operated water tube wells or diesel operated engines (called peter engines) to energize pumps.

According to growers, high cost of utilities and inputs has squeezed their profitability in the recent years as they are not getting corresponding increase in price of their produce.

High Incidence of Diseases and Pests:

There are several pests and diseases which are common threats to the citrus farming in Pakistan. Diseases Pests include Aphids, Citrus Leaf Minor, Lemon Butterfly, Citrus Whitefly, Red Scales, and Foot Rot, and diseases are Withertip, and Citrus Canker (Pakissan.com, 2008). Citrus Canker is caused by the bacterium *Xanthomonas compestris. pv. citri* (Burhan, Sahi, & Ahmad, 2007, p. 1867).

The incidence of Citrus Canker is considered a major threat by many citrus producing countries of the world. Citrus canker played havoc with the citrus industry in Florida, USA in the past. The devastation caused was grave and threat so eminent that government authorities responsible for plant protection and quarantine intervened by destroying (burning) almost the entire production base to eradicate the disease.

During an internal review, the team decided to further probe into the matter to understand the situation viz. a viz. Citrus Canker incidence in Kinnow growing areas of Sargodha/Bhalwal and its possible implications. A meeting was convened at Bhalwal with participation of leading growers, citrus researchers and extension experts to specifically understand the extent of Citrus Canker disease, its affect on the orchard health and productivity and threat emanating from the incidence of Canker as a disease that is considered highly communicable in other parts of the world. Meeting was attended by J E Austin team of consultants besides researchers from Citrus Research Institute Sargodha, Department of Extension Scientists, leading growers and exporters (list of attendees enclosed in Annex A). The key findings from the meeting are summarized below:

The incidence of Canker was detected in several areas. The disease has been reported to affect plants in the nurseries and young nursery plants in the orchards particularly.

Haji Muhammad Azam, a leading grower and a citrus expert shared that due to some factors, the fully grown plants have acquired immunity from the disease and disease symptoms as well as affects are not as pronounced in fully grown plants as in the young plants. He maintained that the Kinnow plants are apparently more resistant to the disease as compared to other citrus varieties like sweet oranges, lime and lemon. He maintained that almost perpetual wet conditions and wind were responsible for the rapid spread of canker in Florida. In Kinnow growing belt in Pakistan, dry conditions for most of the summer with a very high temperature (up to 48 $^{\circ}$C) in the months of May and June are thought to help subside the incidence of bacterial disease and lack of winds prevent spread of the same to other orchards in the vicinity of affected plants.

The participants maintained that although incidence of Citrus Canker along with other diseases was contributing to low productivity and poor product quality, its incidence was not an existential threat as in case of Citrus industry in Florida USA and some other parts of the world.

Experts from Citrus Research Institute agreed with this observation. The J E Austin team in order to get further expert opinion approached Dr Iqrar Ahmed Khan, an eminent Citrus Expert and Vice Chancellor of University of Agriculture Faisalabad, who confirmed the opinion expressed by other experts. He however supported the idea to undertake a comprehensive scientific study to investigate the affects of Citrus Canker on the plant health and therefore the yield and quality of diseases Kinnow variety in Particular.

Incidence of Citrus Canker along with other citrus diseases was regarded by all the participants as a key constraint to productivity and quality of produce faced by Kinnow producers in the areas. Extension expert highlighted the importance of following a balanced plant protection regime in the affected orchards. The participants also agreed that citrus leaf miner insect was the main cause of citrus canker and plants get infected during the early stages, especially in the nurseries. Absence of secured nursery premises was considered a major constraint.

Extension expert also mentioned that several other insects were affecting the quality of product and also resulting in lower yields. For example Citrus Psylla, a brown colored insect attacks the leaves and branches resulting in substantial reduction in yield. Citrus leaf miner attacks the leaves, turning them curled and deformed. Lemon Butterfly mainly attacks the fresh leaves. Citrus Whitefly attacks the leaves, sucks the sap and thus causes damage to quality and loss in yield. Red Scales are sucking type of insects and cause damage to Kinnow and sweet oranges. They are mainly prevalent in the province Punjab and have the capability to survive throughout the year. Foot Rot is a fungus. It attacks the roots of trees to such an extent that tree gradually gets dried.

Withertip, a disease makes the branches and fruits of the affected trees, gradually dry up. And Citrus Canker is a bacterial disease, which cause damage to leaves and the fruits by forming canker (like spots) on the leaves and stems, resulting into loss in quality and reduction in yield. Losses due to diseases, insects and pests were very high.

Incidence of High number of Seeds in Pakistani Kinnows:

Average number of seeds in one Kinnow fruit was reported to be 12.2 as compared to 11.2 in case of musambi, 9.5 in feutral and 8.8 in succari by Khan (2006). Number of seeds found in Pakistani Kinnow, ranges from zero to 54, which are considered a major deterrent to consumption of Pakistani Kinnow especially in the European markets. Seedless citrus fruits from other competing countries are highly preferred over seeded variety Pakistan is exporting.

The Orange Research Institute, Sargodha has reported that a 'less seeded' (i.e. 2-4 pips) variety of Kinnow has been developed there, however it is under the process of certification. It is reported that Citrus Research Centre, located at the University of California, Riverside has developed a seedless Kinnow variety. Many growers are hoping that with the help of University of California, a seedless variety may be introduced in Pakistan to fetch higher prices in the international markets in the due course of time. They somehow are not very optimistic about the efforts of Pakistani research institutions to develop a seedless Kinnow variety.

Shorter Harvest Period for Pakistani Kinnows:

Peak production season of Kinnow in Pakistan is from December to Mid March. Therefore presence of Pakistani Kinnow in the world market is for relatively a brief small span of time. In contrast competing countries like Turkey, Morocco, Brazil, USA and Spain have extended their harvesting period by introducing multiple varieties (early and late maturing) across various production regions. Product from the competing countries is available for up to 180 days as compared to 75 days for Pakistan.

Exporters are of the opinion that availability of different maturing varieties is important for the competitiveness of the value chain. Brief harvesting season also has implications for the processing plants as they remain idle for rest of the year. Their low capacity utilization affects their competitive position.

Quality of Harvesting Labor's Skills:

Due to poor skills of the contract labor, a significant percent of fruit harvest is damaged (reported between 8-10%). Due to poor or careless handling, skin is damaged during the harvesting and transportation processes. This fruit otherwise may be fit for export and may get full economic value instead of selling at discounted rates.

It was mentioned during the interviews and FGDs that lack of skilled labor was compounded over the time. An interesting dimension came into discussion that due to lack of awareness on part of the contract labor, diseases were transferred from one orchard to another as bio security of orchards was compromised due to use of same hand tools and same cloths (which catch disease during the picking, pruning processes).

Weak Sanitory and Phytosanitory Compliance Capacity:

Satisfying health and food safety requirements of import markets, has become a major challenge for Pakistani exporters. EU requirements are particularly strict for food safety. Sanitary standards in the developed world are driven by consumer demands and any kind of exemption from meeting them is not possible. Compliance is difficult and costly; it requires investment in laboratories, safety and management systems, and technical expertise.

To fulfill the SPS requirements of the developed countries, Pakistan needs compliance capacities on several food safety standards. Industry needs to train laborers/workers working in the processing plants and the farmers in the fields. Fresh Kinnow Industry is facing a severe shortage of well trained

technical staff that has capacity to understand and comply with food safety and phytosanitory requirements.

Although there are a couple of good inspection bodies present in Pakistan and have been providing necessary support to Kinnow exporters, sufficient capacities do not exist at the level of service providers and within the exporting enterprises. Pakistan lacks a proper pre-inspection system. Despite keen desire by leading exporters to strengthen capacities in this regards, they are facing difficulties due to institutional weaknesses on part of the designated public sector institutions dealing with animal safety, plant safety and food safety regulations. The exporters mentioned that Department of Plant Protection does not have enough staff capable of inspection. They are of the opinion that there is an intense need to revise the acts and ordinances being implemented by the concerned ministry (Ministry of Food Security, after the devolution of Federal Ministry of Food and Agriculture). According to some leading exporters, weak performance of Department of Plant Protection (DPP), Ministry of food security is hurting Kinnow exports and causing hardships to exporters who are making efforts and investment to develop SPS related compliance capacities. The country is earning a bad name due to issuance of certificate by DPP without proper inspection of export bound shipments. Exporters maintain that DPP need to employ enough numbers of qualified inspectors having capability and authority to inspect the farms and processing plants according to the international standards and also supervisors which supervise the inspectors. Like similar institutions operating in other countries. Poor trust on part of the quarantine and food safety inspection authorities of importing counties like Russia has resulted in ban on import of Pakistani Kinnows.

As per UNIDO experts, an effective SPS management system also requires a policy making institute at the federal level, with provincial governments having the mandate of implementation. The implementation system should have inspectors at district and farm level for effective SPS management. Parallel to the SPS management system a strong food safety management and inspection system is also required.

According to TRTA survey, majority of producers, processors and exporters were not aware of the Sanitory and Phytosanitory (SPS) requirements of importing countries under WTO regime. Due to knowledge gaps, many exporters have learned the hard way implications of non-compliance to the SPS regimes in countries like Russia. During a meeting with Kinnow exporters in Sargodha, a leading exporter explained that poor understanding on part of many Pakistani exporters, especially the newer ones has hurt the industry in more than one ways. Apart from financial losses, they bring poor name to the country and consequently there is a strong perception among the importers that Pakistan is a low quality/2nd grade exporter of citrus as compared to other suppliers. This contributes to the low price realization phenomena as well.

High loses during the post-harvest handling:

During the review of earlier studies on Kinnow, it was learnt that several studies had highlighted the issue of high post harvest losses in Pakistan. For example, Johnson (2006, p. 2) had estimated that post-harvest losses of citrus fruits in Pakistan were at 40 percent. Similarly, according to ACIAR (2008) study, 35 percent of the total produce of citrus in Pakistan was lost during pre and post harvest stages, and these losses were attributed to poor disease management practices, vagaries of

weather, delays in harvest, poor harvesting practices, poor road conditions and cold storage facilities, oversupply of the product in some years besides Kinnows' soft skin.

During the validation process, the consultant learned that whereas the overall produce wastages had decreased as compared to the ones reported in earlier studies, the value chain still was losing economic value of produce due to various weaknesses in the harvesting and post harvest handling processes. According to a leading exporter who has backward integrated operations into processing and production, there was practically no "wastage of produce" in their system from orchard to exports as such. He however mentioned that there was loss of economic value during the chain due to weak practices and management and reported that to be between 5-7%. He attributed that to the quality of fruit deterioration because of disease incidence, especially citrus greening, citrus scab, and skin damages caused by insect pests in the orchards, skin damage during harvesting and transportation. As per an estimate of Kinnow processor 2-5% fruit gets damaged during the transportation. Due to skin damage, the same cannot be included in category A. Processors believe that due to low recovery of category A and B, their overheads and working capital needs also increase, increasing their cost of doing business. Although they have not calculated the extent of that, they feel their profitability is definitely hurt.

Inadequate Cold Chain Facilities:

A study by Mahmood & Sheikh (2006) reported that there were inadequate cold storage facilities in the Kinnow producing areas. The exporters and traders usually store the fruit in cold stores available in the vicinity of wholesale markets. Moreover, quality of cold storage facilities was very poor. Total storage facility for all fruits and vegetables in the country were reported around 0.7 million tones out of which only a fraction of approximately 70-80 thousand tones capacity was generally available for storing Kinnow during the peak period.

During the validation exercise, it was found that whereas the overall situation had improved significantly since 2006-07 and more than 15 top exporters had their own cold storage facilities to meet their requirements. However, cold storage facilities were inadequate as compared to the processing capacity of Kinnow processing faculties. Many processors and exporters therefore cut corners by shifting their processed fruit into refrigerated containers for onwards shipments without cooling the product down to required temperature (2 Degree Centigrade). This results in inferior quality of product at arrival. Further investment in blast chilling and cold storage facilities are a must to increase exports.

Poor Transportation Facilities:

Kinnow Value Chain actors have been able to address the issue of shortage of refrigerated containers for exports with the collaboration of shipping companies operating out of the region. According to leading exporters, the issue of high rents still persists. The exporters have also made arrangements to plug refrigerated containers en route to Karachi port to maintain cargo temperatures during the transportation from processing plants to Karachi port. Previously quality of fruit was affected as drivers of the refrigerated containers used to switch off the refrigeration to reduce the consumption of fuel (diesel).

During the peak season of Kinnow crop production, gap between demand and supply of the refrigerated containers grows enormously, and shipping companies increase their rates, making refrigerated transportation very expensive for the exporters and a compromise on quality of services. According to exporters, the refrigerated containers are required to maintain a temperature

between 2-4^{o}C, however, many a times refrigerated transport operators do not maintain required standards. This also hurts exporters as quality of fruit is affected and result is spoiled fruit on arrival.

Relationships among the Value Chain Actors:

The existing relationships among the value chain actors may be characterized as "poor cooperation" caused by the "mutual low trust". This assessment found that there is a general mistrust among the value chain actors. Even growers tend to be more competitive rather than collaborative in areas they do not have any clash of interests. Flow of information and sharing of experience is generally weak and superficial. One of the reasons that good practices do not propagate despite the fact that more progressive and resourceful has access to such information. The role of existing growers association "Pakistan Kinnow growers Association Sargodha" is insignificant as compared to growers association in other Citrus producing countries.

Similarly the exporters' association is generally controlled by few top exporters of fresh fruits and vegetables. The association is managed by a club with limited access to information to members outside the club.

Limited flow of information and resulting coordination between producers, processors and exporters may be attributed to cultural reasons and some historical reasons as well, yet it is imperative for the competitiveness of the value chain. This consultant therefore is of the considered opinion that unless the value chain actors interact on a platform to increase level of cooperation, the effectiveness of all efforts on a piece meal approach would not give desired results. Any intervention to provide ways and means for better dialogue among the stakeholders, enabling them to realize importance of collaboration among themselves and facilitating them to enhance level of trust between them could pave a way for better cooperation among them for mutual (collective interests).

Poor Perception/Image of Pakistani Kinnow:

Pakistani Kinnow is regarded as B grade citrus for various reasons. Incidence of high number of seeds and skin blemishes are regarded as top reasons for the perception. Pakistani Kinnow exported to European markets are marked as 'B grade Citrus' to permit access to market. According to exporters, it is therefore difficult for them to negotiate better prices.

Pakistani exporters are generally targeting lower end of the market invariable in all the markets they are exporting to. They are unable to penetrate in higher paying markets due to low quality perception attached to Pakistani Kinnow.

This is contrary to the general perception among the growers, processors as well as the policy makers who believe that Pakistani Kinnow is a premium product due to its unique aroma, flavor and taste attributes. The export data as well as the insights shared by leading exporters who frequently visit international trade fares and have market intelligence on their competitors confirm the trend that Pakistani Kinnow is being replaced by other easy peelers e.g. seedless Tangerines from China, and seeded Mandarins from China. Therefore Pakistani Kinnow usually gets low preference over its competing products and even when Mandarins are not available in certain time windows, the price offered to Pakistan product is very low (usually in the range of 50% Turkish or Moroccan Clementine)

Access to Markets:

Pakistan Kinnow is facing difficulties in accessing several markets. Russia, Iran and Indonesia have had either banned imports from Pakistan or have imposed high tariffs in the past. Access to

European markets is considered a barrier due to non-tariff or SPS related compliance requirements. Exporters want to diversify their markets they find the potential. However they need support in understanding the market needs and establishing linkages as the entire process is resource intensive and time consuming.
Incidentally neither the individual exporters, nor the exporters' association or government support agencies are geared up for an integrated campaign in this regard.

It has been found during the interviews with the exporters and association that they feel that they need capacity to build new markets and is willing to undertake efforts. They however look towards TDAP or donor funded projects for support.

Quality of Citrus:
Several studies conducted in the past have identified that quality of Kinnow has been deteriorating over the years. During a survey conducted by Mahmood & Sheikh (2006) exporters expressed their opinion that quality of Kinnow had gradually deteriorated. The study concluded that diseases and insect pests were mainly responsible for it. Poor crop management practices (planting, pruning, fertilization, irrigation and spraying) had also contributed towards deterioration of quality and lower value in the international market (Mahmood & Sheikh, 2006).
During the validation process, the gravity or the extent of deterioration has fully come to fore. According to leading processors, they were able to recover only 45-50% "A" category product for the export shipments last year. This has come down from 65-70%% a few years ago.

According to results of a comprehensive survey conducted by CABI[2], exporters highlighted several issues related with quality of Pakistan Kinnow. First issue relates with skin of the fruit. They indicated that skin of Pakistani Kinnow is becoming thicker and blemished, while in the international market easily peal able citrus fruits without any mark or spot are preferred. They also pointed out that shape of Pakistani Kinnow was not round in all cases, eventually; its acceptance in the international market is negatively affected. Third issue pertains to quality of fruit on arrival at destination ports, attributed to variation in the temperature in the cold storages, and containers.

Exporters pointed out that due to quality issues, per unit price earned by Pakistani Kinnow was low. They think improvement in cold storage facilities; improvement in picking practices and improvement in transport facilities can address many quality related issues once product has been harvested.

Institutional capacity to meet Compliance Requirements:
Kinnow Exporters share that most of the importers, especially from the developed countries demand traceability systems in place. Many demand HACCP [Hazard Analysis and Critical Control Points] Certification from the exporters to ensure that a mechanism of systematic preventive approach to food and pharmaceutical safety is implemented by them, while addressing physical, chemical, and biological hazards. Similarly many importers require that their suppliers obtain produce from orchards that are GlobalGAP certified. Whereas there are only few dozen (51 GlobalGAP certified farms in Pakistan as of October 2013 (Country Director Bureau Veritas) corresponding number for competing countries like China and Turkey run into hundreds.

[2] CABI is an inter-governmental, not-for-profit organization that was set up by a United Nations treaty. It serves 48 member countries.

To comply with the standards and the requirements of international markets it has become essential that Pakistani producers and exporters have ready access to the internationally accredited product testing laboratories. It is imperative that test results are accepted worldwide.

As reported by UNIDO study under TRTA program, there were 20 accredited testing laboratories of which six laboratories cater for microbiology testing and seven laboratories conduct chemical testing. According to the study, these accredited testing laboratories were enough to meet the demands of the country for product testing of agro based exports. Kinnow exporters however feel that internationally accredited laboratories should be near the main Kinnow citrus production clusters as time taken and cost attached with standard tests the exporters need frequently are considered as a constraint. Currently, exporters have to send their samples to PCSIR laboratories, Lahore and NIAB, Faisalabad for testing. This consumes a lot of time. In a meeting with leading exporters, need for an internationally accredited laboratory at Sargodha was expressed.

Weak Role of Value Chain Support Organizations

Government organizations like PHDEC, SMEDA, PAMCO, TDAP, Punjab Board of Investment and Trade (PBIT), Citrus Research Institute Sargodha, Post Harvest Research Institute, Faisalabad, Agri-Extension Department, Agribusiness Support Fund and donor agencies working for development of Horticulture sectors provide support to sector stakeholders.

According to one leading exporter there were 17 different entities working to facilitate or support horticulture sector and Kinnow as such. The exporter implied that in spite of many institutions working for the same cause, the end results were not improving for the value chain. It was a unanimous view in the validation workshop attended by representatives of various value chain stakeholders and representatives of support institutions that there was an apparent lack of effectiveness of efforts and money spend in this regards attributed to:

- Lack of coordination among the support institutions and donor funded projects, resulting in duplication of efforts in many cases and lack of efforts in other equally essential areas where efforts are needed to alleviate gaps/weaknesses in the chain;
- Quality of technical inputs,
- Effective management of projects/interventions;
- Lack of continuity,
- Lack of Joint ownership by value chain actors/stakeholders

Whereas there may be several possible solutions to improve the existing situation, in several countries specialized institutions have played an instrumental role in the development of citrus industry. For example, Citrus Board of South Australia (CBSA) has played an instrumental role in the development of citrus industry in Australia (CBSA, 2001). Similarly an institutional support system exists for citrus value chains in Spain, Turkey, Morocco and USA as well.